

September 6, 2007

The Honorable Chairman and Members of the Hawaii Public Utilities Commission Kekuanaoa Building 465 South King Street, First Floor Honolulu, Hawaii 96813

2CDs enclosed I confidential

Dear Commissioners:

Subject: Docket No. 2006-0386

HECO 2007 Test Year Rate Case - August 2007 Supplement

The factual information and documents attached hereto are submitted pursuant to and in support of the Stipulated Settlement Letter between Hawaiian Electric Company, Inc. ("HECO" or "Company"), the Division of Consumer Advocacy of the Department of Commerce and Consumer Affairs ("Consumer Advocate") and the Department of Defense ("DOD") (collectively referred to as the "Parties") filed September 6, 2007, which provides in relevant part that "HECO will supplement the record with the information provided to the Consumer Advocate and the DOD during the settlement discussions to support the agreements set forth in Exhibit 1 of this settlement letter, to the extent that such agreement relied upon the information provided by HECO . . . "

The information and documents were considered by the Parties, along with the other information available to the Parties, in negotiating the global compromise agreement regarding revenue requirements and other matters, and are being provided to the Commission solely for the purpose of supporting the Stipulated Settlement Letter in its entirety. The documentation includes confidential information which the Company is filing subject to Amended Protective Order No. 23378, dated June 4, 2007.

Very truly yours,

Dean K. Matsuura

Manager, Regulatory Affairs

Enclosures

cc: Division of Consumer Advocacy
Dr. Khojasteh Davoodi
Randall Y.K. Young, Esq.
Sawvel & Associates, Inc.
Utilitech, Inc.
Ralph Smith, Larkin & Associates
Maurice Brubaker, Brubaker & Associates

PARTIAL CONFIDENTIAL (IN SEALED ENVELOPE)



Hawaiian Electric Company, Inc. Docket No. 2006-0386 Test Year 2007

Estimation of Test Year Revenue - June 2007 Update

	Present Rates (\$000S)						Current Effec	tive Rates (\$0	00s)		-		
	Rate	Forecast					Interim Rate	Base Including			INTERIM		
Line	Schedule	MWh	Base	AES	FOA	Total	increase %	Interim Increase	AES	FOA	SURCHARGE 1	Total	
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
1	Я	2,128,900	\$261,394.4	(\$1,061.5)	\$156,261.3	\$416,594.2	6.60%	\$278,646.4	(\$1,061.5)	\$156,261.3	\$1,477.5	\$435,323.7	R
2	G	371,800	\$50,759.8	(\$206.1)	\$27,290.1	\$77,843.8	5.97%	\$53,790.2	(\$206.1)	\$27,290.1	\$258.0	\$81,132.2	G
3	J	2,068,800	\$208,703.1	(\$847.3)	\$151,849.9	\$359,705.7	6.40%	\$222,060.1	(\$847.3)	\$151,849.9	\$1,435.7	\$374,498.4	J
4	Н	40,500	\$4,138.4	(\$16.8)	\$2,972.7	\$7,094.3	6.68%	\$4,414.8	(\$16.8)	\$2,972.7	\$28.1	\$7,398.8	Н
5	PS	835,857	\$74,357.4	(\$301.9)	\$61,351.9	\$135,407.4	7.65%	\$80,045.7	(\$301.9)	\$61,351.9	\$580.1	\$141,675.8	PS
6	PP	2,061,983	\$169,135.5	(\$686.7)	\$151,349.6	\$319,798.4	7.04%	\$181,042.6	(\$686.7)	\$151,349.6	\$1,431.0	\$333,136.5	PP
7	PT	175,161	\$13,316.4	(\$54.1)	\$12,856.8	\$26,119.1	0.00%	\$13,316.4	(\$54.1)	\$12,856.8	\$121.6	\$26,240.7	PT
8	F	37,800	\$4,008.7	(\$16.3)	\$2,774.5	\$6,766.9	9.33%	\$4,382.7	(\$16.3)	\$2,774.5	\$26.2	\$7,167.1	F
9	Total	7,720,801	\$785,813.7	(\$3,190.7)	\$566,706.8	\$1,349,329.8		\$837,698.9	(\$3,190.7)	\$566,706.8	\$5,358.2	\$1,406,573.2	

¹ Interim Surcharge for DG Fuel, DG Trucking, LSFO Trucking of 0.0694 cents/kWh is applied to Forecast MWh

Estimation of Test Year Revenue - Direct Testimony

		-		Present Rates (\$000S)					Current Effect	tive Rates (\$000	s)		
	Rate	Forecast					Interim Rate	Base Including					
Line	Schedule	MWh	Base	AES	FOA	<u>Total</u>	increase %	Interim Increase	AES	FOA		Total_	
		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
10	R	2,128,900	\$261,396.5	(\$1,061.5)	\$155,388.4	\$415,723.4	6.60%	\$278,648.7	(\$1,061.5)	\$155,388.4		\$432,975.6	R
11	1 G	371,800	\$50,759.8	(\$206.1)	\$27,137 <i>.</i> 7	\$77,691.4	5.97%	\$53,790.2	(\$206.1)	\$27,137.7		\$80,721.8	G
12	2 J	2,068,800	\$208,770.8	(\$847.6)	\$151,001.7	\$358,924.9	6.40%	\$222,132.1	(\$847.6)	\$151,001.7		\$372,286.2	J
13	3 H	40,500	\$4,138.4	(\$16.8)	\$2,956.1	\$7,077.7	6.68%	\$4,414.8	(\$16.8)	\$2,956.1		\$7,354.1	Н
14	4 PS	835,857	\$74,352.2	(\$301.9)	\$61,009.2	\$135,059.5	7.65%	\$80,040.1	(\$301.9)	\$61,009.2		\$140,747.4	PS.
15	5 PP	2,061,983	\$169,286.6	(\$687.3)	\$150,504.1	\$319,103.4	7.04%	\$181,204.4	(\$687.3)	\$150,504.1		\$331,021.2	PΡ
16	6 PT	175,161	\$13,316.4	(\$54.1)	\$12,785.0	\$26,047.3	0.00%	\$13,316.4	(\$54.1)	\$12,785.0		\$26,047.3	PT
17	7 F	37,800	\$4,008.7	(\$16.3)	\$2,759.0	\$6,751.4	9.33%	\$4,382.7	(\$16.3)	\$2,759.0		\$7,125.4	F
18	B Total	7,720,801	\$786,029.4	(\$3,191.6)	\$563,541.2	\$1,346,379.0		\$837,929.4	(\$3,191.6)	\$563,541.2		\$1,398,279.0	

SECURITY EXPENSE UPDATE

The DOD proposes a reduction to HECO's Other Production O&M Expense in the 2007 test year for Security expenses (for outside security services) of \$117,000, reducing Security expenses from \$730,000 (response to CA-IR-339, Attachment 3, page 1) to \$613,000 (DOD-116). The DOD annualized the total Security expenses of \$306,676 for January through June, 2007 reported by HECO in the response to CA-IR-486, page 3, to obtain its proposed expense level of \$613,000.

In reviewing the amounts provided in the response to CA-IR-486, HECO has found that the recorded expense level of \$266,604 to June 9, 2007, was under-reported due to the following reasons: 1) invoices for the period December 31, 2006 to January 6, 2007 were removed from the 2007 total when they should have been included in 2007, and 2) a total of four other invoices were missing in the total for the period January to June 9, 2007. These invoices are in review and will be paid once the review is completed. In addition, HECO has recalculated the estimated amounts for outstanding invoices for the remainder of June 2007. The recalculated amount for January to June 2007 is \$328,200, as shown in HECO T-6 Attachment 1(A).

The DOD's proposed 2007 estimate, based on annualizing the expense through June 2007, does not include the impact of the increase in hourly rate, effective July 1, 2007, described in the response to CA-IR-2, Attachment 15, page 16. For the first six months of 2007, the hourly rate was \$19.58. Effective July 1, 2007, this rate increases to \$19.92, or an increase of 1.74%.

Annualizing the January to June 2007 amount of \$328,000 from Attachment 1-A, and applying the rate increase of 1.74%, results in an estimated total for the second six months of 2007 of \$334,000. The annualized total for 2007 then becomes \$328,000 + \$334,000 or \$662,000.

HECO T-6 ATTACHMENT 1 (DOD) PAGE 2 OF 2 AUGUST 2007 SUPPLEMENT

The proposed calculation also excludes the expenses for Kahe camera repairs of \$6,600, Waiau alarm monitoring of \$15,300, and Waiau camera repairs of \$8,800, referred to in HECO's response to CA-IR-339, Attachment 2. These amounts total to \$30,700. When added to the subtotal above, the annualized security expense total becomes \$693,000.

As the DOD describes, HECO's security contractor, Discreet, LLC, has not been able to provide the security officers and hours stipulated in its contract with HECO. HECO has had discussions with Discreet, LLC and, beginning September 9, 2007, Discreet, LLC will provide a minimum of eight security officers to HECO. These eight security officers will replace the seven AKAL security officers being utilized at the Iwilei Tank Farm and Barbers Point Tank Farm. Four of the seven AKAL security officers will be reassigned to duty stations at the power plants to support the security staffing for the remainder of the year. Four officers working 40 hours per week at \$19.92 per hour and for 16 weeks will total \$51,000.

When the \$51,000 is added to the \$693,000 from above, the total security expense for 2007 is estimated to equal \$744,000. As stated in the response to CA-IR-486, page 3, HECO fully expects that the funds for annual security services, as originally estimated at \$730,280, will be spent in 2007.

HECO T-6 ATTACHMENT 1(A) - (DOD) PAGE 1 OF 1 AUGUST 2007 SUPPLEMENT

SECURITY EXPENSE UPDATE

HAWAIIAN ELECTRIC COMPANY INC. 2007 RATE CASE

Production O&M Security Expense Update -- January to June 2007

		Waiau PP	Kahe PP	Hono PP	
		FA000623	FA000624	FA000625	
<u>Peri</u>	<u>od</u>	<u>Amount</u>	Amount	Amount	
12/31/2006	1/6/2007	\$4,741	\$4,9 17	\$3,474	
1/7/2007	1/13/2007	\$4,856	\$5,311	\$3,289	
1/14/2007	1/20/2007	\$4,743	\$5,296	\$3,289	
1/21/2007	1/27/2007	\$4,856	\$4,699	\$3,289	
1/28/2007	2/3/2007	\$4,856	\$4,375	\$3,289	
2/4/2007	2/10/2007	\$4,885	\$4,533	\$3,289	
2/11/2007	2/17/2007	\$4,758	\$4,797	\$3,289	
2/18/2007	2/24/2007	\$4,464	\$4,259	\$3,289	
2/25/2007	3/3/2007	\$4,386	\$4,425	\$3,289	
3/4/2007	3/10/2007	\$4,543	\$4,386	\$3,289	
3/11/2007	3/17/2007	\$3,759	\$4,642	\$3,289	
3/18/2007	3/24/2007	\$4,210	\$5,138	\$3,128	
3/25/2007	3/31/2007	\$4,447	\$4,844	\$3,289	
4/1/2007	4/7/2007	\$4,764	\$5,019	\$3,289	
4/8/2007	4/14/2007	\$4,405	\$5,002	\$3,289	
4/15/2007	4/21/2007	\$4,758	\$4,847	\$3,275	
4/22/2007	4/28/2007	\$4,229	\$4,804	\$3,289	
4/29/2007	5/5/2007	\$4,211 (1)	\$5,001	\$3,289	
5/6/2007	5/12/2007	\$4,719 (1)	\$4,655 (1)	\$3,289 (1)	
5/13/2007	5/19/2007	\$4,577	\$4,719	\$3,133	
5/20/2007	5/26/2007	\$4,621	\$4,887	\$3,172	
5/27/2007	6/2/2007	\$4,539	\$4,421	\$3,501	
6/3/2007	6/9/2007	\$4,543	\$4,738	\$3,299	
6/10/2007	6/16/2007	\$4,386 (2)	\$4,856 (2)	\$3,289 (2)	
6/17/2007	6/23/2007	\$4,987 (2)	\$4,875 (2)	\$3,289 (2)	
6/24/2007	6/30/2007	\$4,713 (2)	\$4,434 (2)	\$3,172	
	Total	\$118,955	\$123,882	\$85,362	\$328,200

Notes:

- (1) Invoice under review and will be paid once review is completed.
- (2) Contractor has not yet billed HECO; revised billing estimates reported in HECO's response to CA-IR-486, Attachment 3.

HECO T-6 ATTACHMENT 3 PAGE 1 OF 3 AUGUST 2007 SUPPLEMENT

PRODUCTION O&M LABOR UPDATE

The Consumer Advocate proposed a downward adjustment of \$953,000 to the Other Production O&M Labor Expense as calculated in CA-WP-101-C4 then posted at CA-101, Schedule C-4, which includes the following three components:

1. Operations Staffing Level – Adjusted to Average: (\$ 382,907)

2. Maintenance Staffing Level – Adjusted to Average: (\$ 971,758)

<u>(\$ 953,000)</u>

However, the Consumer Advocate also stated its willingness to consider equitable revisions to its labor adjustments associated with maintenance accounts if HECO can show clear evidence that it is requiring additional supplemental labor to meet normal, ongoing maintenance requirements because of the inability to fill vacant positions in the Maintenance Division. CA-T-1, page 45.

HECO's use of supplemental labor to perform maintenance work in 2007 is illustrated in Attachment 3(A) to this Response. As shown in this Attachment (and also in Attachment 2 to the response to CA-IR-419), the actual expense for supplemental labor for January to May 2007 was \$2,009,000, or an average of approximately \$400,000 per month. In June and July 2007 the actual expense for supplemental labor was \$379,000, or an average of approximately \$190,000 per month. One reason that the average monthly supplemental labor O&M expense decreased for June and July 2007, is that a significant portion of the supplemental labor (i.e., electricians and instrument technicians) that was contracted by the Maintenance Division was assigned to perform pre-outage

\$460,000

work on the "Kahe 3 Boiler Control Upgrade" capital project (see Attachment 1 to the response to CA-IR-307, "P9539000"). As shown on Attachment 3(B) to this Response, capital expenses of approximately \$147,000 were incurred for supplemental labor for demolition and installation work on the Kahe 3 Boiler Control Upgrade project, and these incurred costs are not included in compilation of O&M expenses provided as Attachment 3(A) to this Response. If these supplemental labor resources were not required to support work on the capital project they would have likely been utilized for other maintenance activities, and added to the O&M expense for June and July 2007. The total actual O&M expense for supplemental labor from January through July 2007 was \$2,388,000, which was \$122,000 more than the amount included in the 2007 budget for the entire year.

For the remainder of 2007, HECO will continue to utilize supplemental labor to complement its maintenance work force to compensate for the unfilled vacancies and perform the required work. As shown on Attachment 3(A) to this Response, the existing commitments and projections for supplemental labor to be charged to expense are:

Commitments (August through December 2007)

SUBTOTAL

Kahe 3 Overhaul	\$515,000
Station Maintenance	<u>\$333,000</u>
SUBTOTAL	\$848,000
Additional Projected Expense (August through December 2007)	
Station Maintenance	\$160,000
Station MaintenanceWaiau 5 Overhaul	

HECO T-6 ATTACHMENT 3 PAGE 3 OF 3 AUGUST 2007 SUPPLEMENT

The total expense for supplemental labor for 2007 will be the sum of actual expenses through July, plus commitments and projections for August through December, or \$3,696,000 (i.e., \$2,388,000 + \$848,000 + \$460,000). The 2007 test year estimate for supplemental labor is \$2,266,000 (which differs from the value in Attachment 10 to the response to CA-IR-74 of \$2,176,000 for the reason provided in the footnote in Attachment 3(A) to this Response). Thus, HECO will be spending approximately \$1,430,000 (i.e., \$3,696,000 - \$2,266,000) more for supplemental labor in 2007 than the amount included in the 2007 test year estimate for supplemental labor for maintenance work, and this excess expenditure is for the use of supplemental labor to meet normal, ongoing maintenance requirements because of HECO's inability to fill vacant positions in the Maintenance Division. This excess expenditure is larger than the Consumer Advocate's adjustment for Maintenance Staffing by \$458,000 (i.e., \$1,430,000 - \$972,000), and more than offsets the direct labor cost savings associated with vacancies.

Hawaiian Electric Company, Inc. 2007 Rate Case Production Operation and Maintenance

HECO T-6 ATTACHMENT 3(A) PAGE 1 OF 1

AUGUST 2007 SUPPLEMENT

2007 - Maintenance Supplemental Labor Cost Review (in thousands)

(iii iiiododiido)	2007 Test	Act + Comm +	
	Year	Proj	Variance
ACTUALS (Jan - July)			
January - May (CA-IR-419)		\$2,009	\$2,009
June - July		\$379	\$379
Total	\$1,278	\$2,388	\$1,110
COMMITMENTS (Aug - Dec)			
Overhaul-			
<u>Kahe 3- (Start: 6/25/07 - En</u>	<u>d; 9/14/07</u>)		
Bir/Insul Outsource	\$130	\$235	\$105
Electrical Outsource	\$15	\$100	\$85
Technical Outsource	\$20	\$100	\$80
Machinist Outsource	\$15	\$80_	\$65
	\$180	\$515	\$335
Station Maintenance			
Honolulu	\$120	\$63	(\$57)
Kahe	\$150	\$150	\$0
Waiau	\$150	\$120	(\$30)
	\$420	\$333	(\$87)
Total	\$600	\$848	\$248
PROJECTIONS (Aug - Dec)			
Station Maintenance			
Honolulu	\$50	\$50	\$0
Kahe	\$35	\$35	\$0
Waiau	\$75	\$75	\$0
	\$160	\$160	\$0
Overhaul-			
Waiau 5- (Start: 11/03/07 - I	End: 12/31/07)		
Bir/insul Outsource	\$100	\$133	\$33
Electrical Outsource	\$66	\$53	(\$13)
Technical Outsource	\$27	\$47	\$20
Machinist Outsource	\$10	\$67	\$57
	\$203	\$300	\$97
Waiau 9- (Moved out to 200			
Machinist Outsource	\$25	\$0	(\$25)
Total	\$388	\$460	\$72
TOTAL	\$2,266	\$3,696	\$1,430
CA Adj- Maint Average Calc	72,200	40,000	\$972
		-	
VARIANCE		-	\$458

^{(1) -} Per CA-IR-74, total supplemental labor budget = \$2,176k. The difference of \$90k (\$2,266k - \$2,176k) is due to Waiau supplemental labor for asbestos removal work understated by \$90k. \$2,266k is the correct amount.

2201 Project Hierarchy Summary Report

Report	Parameters

Projec	1 :	P9539000	From Date:	06/01/2007	To Date:	07/31/2007		_					
Status	Lel	Proj/WO Number	Project or WO Description	pu .	Total Actuals	Commitment	Material (O/S Sves	Labor	Overheads	Transport	Other	AFUDC
HECO)												
0	1	P9539000	K3 Boiler Control Upgra	ade	12	0	0	0	0	0	0	0	12
0	2	G0004246	K3 Bollar Controls Upg	rade (Engineering)	1,886	0	0	54	935	886	0	0	11
0	3	G0004247	K3 Boiler Controls Upg	rade (Plan/Appr)	2,813	0	0	0	0	0	0	0	2,813
0	3	G0004248	K3 Boller Controls Upg	rade (Eng/Dgn/Mng)	3,216	0	0	0	1,086	952	0	292	888
0	4	PE001657	Mechanical Design	•	17,092	0	0	0	8,752	8,006	0	0	334
0	4	PE001658	Structural Engineering		5,699	0	0	. 0	2,293	3,357	0	0	49
A	4	PE001868	Electrical Eng-K3 Boile	r Ctrls Upgrade	70,378	2,456	0	20,526	16,132	16,499	0	11,553	5,668
0	4	PE002194	Structural Eng - Duct B	iank	3,665	0	744	0	1,273	1,514	0	0	135
0	3	G0008002	K3 BCS-ENG CONSTR	RUCTION	0	0	0	0	0	0	0	0	0
0	2	G0008003	K3 BCS-OUTSIDE EN	GINEERING	125,989	1,007,674	0	118,105	0	0	0	0	7,885
0	2	G0008004	K3 BCS-OUTSIDE CO	NSTRUCTION	0	30,000	0	0	0	0	0	0	0
0	2	G0008005	K3 BCS-HECO LABOR	₹	0	0	0	0	0	0	0	0	0
0	3	PE000861	K3 BCS-HECO LABOR	1	219,879	389,487	20,601	133,488()	34,990	27,902	0	0	2,899
0	2	G0008006	K3 BCS-MATERIALS		149,089	62,679	145,167	°	0	0	0	0	3,902
0	2	G0008007	K3 BCS-REMOVAL W	ORK	0	0	0	0 .	0	0	0	0	0
0	3	PE000862	K3 BCS-REMOVAL W	ORK .	99,129	13,159	120	13,649(1	49,105	36,255	0	. 0	0
			Grand Total Project S	tracture	698,828	1,505,434	166,633	285,820	114,565	95,371	0	11,845	24,593

Actuals June-July 2007 - Supplemental labor cost incurred ED \$147,135

PRODUCTION RESEARCH & DEVELOPMENT UPDATE

The R&D issue relates to the following amounts included in the 2007 test year estimate in the Production O&M block of accounts. (As explained in the response to CA-IR-245, the local EPRI matching funds include projects that apply to other process areas, but the total amount was included in the Power Supply area for budgeting purposes.)

(1)	Local EPRI matching funds	\$249,000
(2)	Recurring renewable energy funds	\$65,000
(3)	Renewable energy initiative	\$300,000
(4)	Biofuels initiatives	\$100,000
(5)	Electronic shock absorber ("ESA")	\$221,000
(6)	Total	\$935,000

The planned uses of these funds at the time the budget was developed were detailed in HECO T-6, pages 71-74, and HECO-629, pages 1-13 (pages 1 and 3 of which were revised in Attachment 1 to the response to CA-IR-245). Historic expenditure levels, as well as the status of activity in 2007, were addressed in the responses to CA-IR-80, CA-IR-183 (ESA), CA-IR-245, CA-IR-341 (USDOE RFP and ESA) and CA-IR-463 (RE initiative and biofuels initiatives).

In CA-T-1 (Schedule C-8), the Consumer Advocate (1) removed ESA funding from test year expenses based upon the uncertain status of future activities and costs related to this project, and (2) reduced the budgeted amounts for the other R&D spending initiatives (which it assumed were \$754,000¹) by one third, offset by HECO's actual spending through April 2007 (\$30,656), to recognize that one third of the year has passed with very little activity or spending to-date, and the

¹ \$754,000 + \$221,000 = \$975,000, not \$935,000. Based on HECO-629, the Consumer Advocate assumed that the \$40,000 for Sun Power for Schools expenses were included in the test year estimate. However, the 2007 budget (and, thus, the 2007 test year estimate) also includes a \$40,000 credit, so that the net amount included in the test year is zero. See response to CA-IR-80. If the inclusion of the \$40,000 is backed out of the Consumer Advocate's proposed adjustment, the Consumer Advocate's adjustment is reduced from (\$442,000) to (\$428,000). See HECO T-6, Attachment 5(P) for the recalculation.

apparent uncertainties and potential delays in actual activities and expenditures. The net effect is to reduce the \$935,000 by \$442,000 to \$493,000. However, the Consumer Advocate then states that, "[i]n the event HECO can firm up its plans and provide evidence of spending commitments for more than \$502,000 (the other 2/3 of \$754,000) to be made within 2007, but after April, and also demonstrate that an ongoing future spending rate in excess of \$754,000 per year is reasonably anticipated, a proportionate reduction in this disallowance should be considered." CA-T-1, page 74.

As is demonstrated below, the \$249,000 for local EPRI matching funds will be expended in 2007 for the seven projects described in HECO-629, as updated in the responses to CA-IR-245 and CA-IR-407. Despite the late start in 2007 (because HECO did not participate in EPRI in 2006), HECO will make payments to EPRI in 2007 for the following projects:

Underground Cable Replacement Policy Development	\$27,500
Demand Control Ventilation Demonstration	\$29,200
Demand Monitoring and Response Applications	\$47,500
Beyond Sun Power	\$31,434
Fargo ACSR compression dead-end connector failure investigation	\$48,397
Underground best practices assessment	\$30,000
T&D Inspector Training	<u>\$35,000</u>
TOTAL .	<u>\$249,031</u>

The specific local EPRI matching fund expenditures are discussed in more detail below.

HECO will expend more than \$244,000 (\$493,000 - \$249,000) in 2007, and the on-going level of activities should continue to increase in the future. Given the strong support of the

Legislature, the State Administration, the Consumer Advocate and the Commission for renewable energy and the use of biofuels, it is clearly in the public interest for <u>more</u> R&D funds to be committed to help overcome the technical, system reliability, and local supply "barriers" to accelerating the development of Hawaii's abundant renewable energy resources:

- Renewable energy initiative As discussed in HECO-629 and CA-IR-245, the funds for this project will be used for collecting wind speed data at the Kahuku military site. HECO has several signed agreements for consultants who will provide necessary services for the project. Copies of those agreements have been provided in Attachments 4 and 5 to the response to CA-IR-407. The wind speed information collected by HECO during this project will be helpful for wind farm developers on Oahu and will support the RFP that HECO plans to issue by the end of 2007.
- Biofuels initiative As discussed in HECO's response to CA-IR-407, HECO has been developing a plan for biodiesel testing in a steam boiler. The test plan includes selection of one of four Combustion Engineering steam boilers on the HECO system based on space availability for biodiesel fuel storage and delivery, infrastructure availability (pump size and pressure rating, etc.), minimum modifications, timing of next planned maintenance outage.
 A Supplemental Project Agreement for this project was signed by HECO and EPRI on August 8, 2007. The total project funding provided in the Agreement is \$500,000, consisting of \$200,000 in 2007 and \$300,000 in 2008. Under the terms of the Agreement, HECO will be invoiced \$100,000 in 2007, and \$150,000 in 2008. By signing this Agreement, HECO will obtain \$250,000 in EPRI funds--\$100,000 in 2007 and \$150,000 in 2008.

- Electronic Shock Absorber The Electronic Shock Absorber (ESA) was damaged in the October 15, 2006 earthquake that originated off the west coast of the Big Island. As discussed below, removal and disposal of the ESA is expected to cost \$20,000 \$35,000 because of the hazardous materials in the ESA. Looking to the future, HECO and Maui Electric Company have partnered with the Hawaii Natural Energy Institute (HNEI) with respect to a proposal submitted to the U.S. Department of Energy by HNEI for Electronic Shock Absorber support-Managing Distribution System Resources for Improved Service Quality and Reliability, Transmission Congestion Relief, and Grid Support Functions.
- Recurring renewable energy funds HNEI has been contracted by HECO to evaluate, document, repair, and maintain data acquisition systems of photovoltaic systems installed under the Sun Power for Schools program as well as systems located at military and other sites. This project builds upon the partnership between HECO and the University of Hawaii in furthering the demonstration and educational aspects of advanced technologies.

In its response to CA-IR-407, HECO provided a monthly breakdown of actual R&D expenses year to-date through June 2007, and updated information concerning local EPRI matching funds, the renewable energy initiative, the biofuels initiative and the Electronic Shock Absorber. The following discussion summarizes developments that have taken place since the submission of HECO's response to CA-IR-407.

Local EPRI matching funds

HECO has signed a multi-year agreement with EPRI (2007-2011). Therefore, HECO is an EPRI member in 2007 and expects to expend to the level projected (\$249,000) in 2007. HECO currently plans to use 2007 local EPRI matching funds totaling \$249,000 for seven research

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projects, including: (1) Underground Cable Replacement Policy Development, (2) Demand Control Ventilation Demonstration, (3) Demand Monitoring and Response Applications, (4) Beyond Sun Power: An Enterprise Approach to Energy and Learning Solutions, (5) Fargo ACSR compression dead-end connector failure investigation, (6) Underground Best Practices Assessment and (7) T&D Inspector Training.

HECO's response to CA-IR-407 provided copies of two EPRI agreements that were being processed, namely the Supplemental Project Agreement for the Hawaiian Electric Company Underground Cable Replacement Policy Development (CA-IR-407, Attachment 2) and the Supplemental Project Agreement for the Demand Control Ventilation Demonstration (CA-IR-407, Attachment 3). Since the submittal of this response, these two Agreements have been signed by EPRI. Attachment 5(A) to this Response is a signed copy of CA-IR-407, Attachment 2. Attachment 5(B) to this Response is a signed copy of CA-IR-407, Attachment 3. HECO recently received invoices from EPRI to match the EPRI funds. Attachment 5(C) to this Response is a copy of the EPRI invoice for the Underground Cable Replacement Policy Development in the amount of \$27,500. Attachment 5(D) to this Response is a copy of the EPRI invoice for the Demand Control Ventilation Demonstration in the amount of \$29,200. Payment is due under each of these invoices on August 22, 2007, and HECO is processing a check to EPRI to match the funding for these two projects. Therefore, \$56,700 of the local EPRI matching funds have been expensed and the projects will commence.

HECO recently received an EPRI Supplemental Project Agreement for a project entitled, "Demand Monitoring and Response Applications." See Attachment 5(E) to this Response. EPRI

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will provide funding of \$47,500, which will be matched by HECO.² HECO signed the Agreement on August 9 and returned it to EPRI by August 10, 2007. Based on past experience, EPRI will sign the agreement and then invoice HECO for \$47,500 within approximately one week of its receipt of the Agreement signed by HECO, and HECO will pay the invoice within one week of receipt of the invoice. In other words, HECO will spend \$47,500 for this project before the end of 2007.

The expenditure of \$56,700 and \$47,500 for the projects described above will account for \$104,200 of the \$249,000 test year estimated expense for local EPRI matching funds during 2007.

HECO has sent the fourth statement of work for a project entitled, "Beyond Sun Power: An Enterprise Approach to Energy and Learning Solutions" (\$31,434 cost match--see Attachment 5(N) to this Response for EPRI TC beyond sun power--draft statement of work) to EPRI on August 9, 2007. EPRI will develop an agreement and send to HECO for signature. HECO will sign and send the agreement back to EPRI. After EPRI signs this agreement, EPRI will invoice HECO for \$31,434 cost match. HECO will process for payment.

The statements of work for the remaining three project agreements will be sent to EPRI no later than August 15, 2007. The following statements of work are attached to this Response as Attachments 5(F), 5(G), and 5(H): "Fargo ACSR compression dead-end connector failure investigation", \$48,397; "Underground best practices assessment, \$30,000; and T&D inspector training, \$35,000. EPRI will develop agreements and send them to HECO for signature. HECO will sign and send the agreements back to EPRI. After EPRI signs these agreements, EPRI will invoice HECO for the respective matching fund amounts: \$48,397, \$30,000 and \$35,000. HECO

This project was changed from the "Thermal and Compressed Air Storage UPS" discussed in HECO-629, page 4, to "Demand Monitoring and Response Applications" because, after further assessment, it was determined that the latter project would benefit a larger number of HECO's customer base.

will process for payment. Once these agreements are signed, HECO will send a check for its share of the costs for each project and thus the balance of the \$249,000 will be expended. HECO anticipates that it will make a payment for these three projects in the total amount of \$113,397 to EPRI within the next few months, and, in any event, before the end of 2007.

Taking into account each of the payments to EPRI discussed above, HECO will spend at least \$249,031 for local EPRI matching funds during the remainder of 2007.

Renewable Energy Initiative

The 2007 test year estimate includes an amount of \$300,000 to be used for renewable energy initiatives. As explained below, approximately \$117,000 of that sum has been expended from the beginning of 2007 through July 31, 2007. In accordance with State law, HECO is working to increase the percentage of renewable energy on its electric system. Wind technology is one renewable technology that is mature.

The 2007 funds are being used for the assessment and evaluation of a wind farm development at a Kahuku military site, specifically, for a stationary meteorological tower, sensors, a mobile acoustical trailer and the installation, monitoring, evaluation and reporting of this effort. HECO has submitted to the Army a proposed wind monitoring program to allow HECO's subcontractors to install, monitor, and evaluate the wind speed and direction at multiple sites for a minimum one-year period. HECO is awaiting final Army approval to enter the property to erect a new meteorological tower and placement of a mobile sodar acoustic trailer for wind speed data collection. On August 9, 2007, the Army informed HECO that it is currently routing the appropriate real estate documents to allow HECO a License to Access, and that the Army does not anticipate any major obstacles to obtaining the necessary signatures. See Attachment 5(I) to this

Response. Once Army approval is received, HECO will work towards obtaining state land board approval.

Once all approvals are obtained, HECO will direct its contractors to install a new meteorological tower and begin data collection. In addition, the mobile sodar trailer will be placed in the field to augment the wind speed data collection. The earliest target for meteorological tower construction and sodar mobilization efforts is early September.

Actual expenses as of June 2007 were \$114,707. See response to CA-IR-407,

Attachment 1. As of July 31, 2007, the actual expenses are \$116,712. The charges to date for this project are related to the Kahuku wind monitoring program at the military site: wind speed sensor equipment installation and wind speed data collection on an existing communication tower; lease payment for use of the communication tower; state Conservation District Use Application ("CDUA") permit development and response to questions; response to Federal Fish & Wildlife ("F&W") questions and conditions; avian radar survey; amendments of the new meteorological tower design as conditioned by state CDUA and federal F&W conditions, sodar mobile trailer evaluation, and other charges.

HECO expects the costs to ramp up during the installation and placement of the monitoring equipment. As noted above, as of August 9, 2007, the Army is routing the appropriate real estate documents to allow HECO a License to Access, and does not anticipate any major obstacles to obtaining the necessary signatures. See Attachment 5(I) to this Response, which is a communication from the Army. If all approvals are received soon, mobilization of the various subcontractors would take about one month. Estimated project expenses for the rest of the 2007 test year would then account for the following: AWS Truewind, \$55,000 (for meteorological sensors installation and calibration, monthly wind speed monitoring from new and existing

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communication towers and mobile sodar trailer, etc.); Eagle Construction, \$70,000 (for installation of the new meteorological tower, including concrete tower foundation and concrete anchors for the guyed wires, installation of bird diverters, and security fences, etc.); B.D. Neal, \$40,000 (for installation of mobile sodar trailer, calibration of instruments and sensors, security fences, etc.); Global Signal, \$9,000 (for lease rent of communication tower); helicopter services, \$10,000 (for lift and removal of mobile sodar trailer at one site--HECO has existing agreement for helicopter services). As noted above, HECO has provided copies of the various signed agreements relating to collecting wind speed data at the Kahuku military site. (See response to CA-IR-407, Attachments 4 and 5.) Thus, the estimated contractor expenses for these activities in 2007 total approximately \$184,000.

The actual expenses of \$117,000 as of July 31, 2007, and the estimated subcontractor expenses of \$184,000, total \$301,000. The 2007 test year estimate for Renewable Energy Initiative expenses is \$300,000.

The wind speed monitoring is a minimum 12-month program, so expenses in this activity will carry over into 2008. Expenses in 2008 will be paid from funds remaining in the \$370,000 budget for subcontractors summarized in HECO-629, page 6.³

As detailed in Docket No. 03-0253 (HECO IRP Evaluation Report), HECO is targeting issuance of a Solicitation of Interest on or about September, 2007, announcing HECO's intent to proceed with an Request for Proposal ("RFP") for approximately 100 MW of non-firm renewable energy. The anticipated RFP to follow is targeted for issuance on or about year-end 2007, with a desired service date for the resource or resources totaling up to 100 MW in the 2010 to 2012

³ Since the time HECO-629 was prepared, the budget for subcontractors has been increased by approximately \$100,000. As noted in HECO-629, page 6, budgets are subject to change based on adjustments to project work scopes.

timeframe. HECO has discussed this RFP process with Army personnel and the Army land agents are working diligently to make this site available for a wind developer to propose this Army site in the upcoming HECO RFP. U.S. Army Corp of Engineers (USACOE) land agents from Baltimore, Maryland have been participating in HECO's Kahuku military wind data collection project weekly team meetings for several months. At the August 2, 2007 weekly meeting, USACOE stated it has developed a "concept package" for leasing Kahuku military lands for commercial wind farm development. USACOE plans to hold an "Industry Forum" in early Fall 2007 for potential commercial wind farm developers and will select a wind farm developer soon after that forum. The wind speed information collected by HECO during this project will be helpful for wind farm developers on Oahu.

Biofuels Initiative

The 2007 estimate included an amount of \$100,000 to be used for initiatives related to biomass energy or biofuels. All funds for the biofuels initiative will be directed towards biodiesel testing in HECO steam boilers on Oahu. As stated in the response to HECO–IR-407, HECO was developing a test plan for biodiesel testing in a steam boiler, schedule and budget. (The test plan includes selection of one of four Combustion Engineering steam boilers on the HECO system based on space availability for biodiesel fuel storage and delivery, infrastructure availability (pump size and pressure rating, etc.), minimum modifications, timing of next planned maintenance outage.) After these items were firmed, HECO indicated that it would enter an agreement with EPRI (to leverage EPRI funds). See HECO's response to CA-IR-407.

Since the submittal of the response to CA-IR-407, HECO developed a draft statement of work for the EPRI agreement. See Attachment 5(J) to this Response for a copy of the draft statement of work). The major tasks are:

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- ➤ Task 1 Fuel Compatibility Evaluation--fuel property and viscosity analyses will be conducted to evaluate the compatibility of biodiesel/LSFO blends with existing fuel delivery and handling systems at the host site. Fuel analyses and viscosity-temperature tests of neat LSFO, neat biodiesel, and a series of biodiesel-LSFO blends (e.g., possible range of 5% to 90% biodiesel) will be conducted to characterize fuel properties and flow behaviors (i.e., viscosity vs. temperature). Data from these tests will help formulate the co-firing test plans, including the identification of test limitations and potential equipment modification requirements.
- ➤ Task 2 Biodiesel Co-firing Test Plan--developing a test plan for co-firing biodiesel with LSFO in a boiler. Information from Task 1 will be used to identify required equipment modifications and support development of the test matrix. The test plan will identify the fuel blends and volume requirements, fuel delivery/mixing procedures, co-firing system design, boiler operating test points, performance and emissions data, testing protocol and instrumentation, and data reduction methodologies. Environmental issues and permit requirements will also be assessed. The envisioned testing may include, but not be limited to, measurements of combustion stability, flame stability, boiler performance, fuel system performance, and emissions (e.g., O2, NOx, CO, CO2, SO2, PM-10, and opacity).
- ➤ Task 3 Procurement and Installation--includes the procurement of biodiesel fuel, and procurement and installation of fuel system equipment, boiler-related components, sensor and emissions analyzers, and data acquisition system. Information from the test plan developed in Task 2 will be used to guide the procurement and installation tasks.
- ➤ Task 4 Shakedown and Testing--equipment and subsystems shakedown will occur. Successful shakedown operations will be followed by co-firing testing and data collection per the test plan developed in Task 2.
- ➤ Task 5 Test Data Reduction and Analysis--includes the analysis of collected data, formulation of conclusions, and preparation of the final report on co-firing tests.

This is a multiyear project where activities and expenses will occur in 2007 and 2008. The steam boiler testing is projected to take place in mid-2008 subject to internal and external approvals.

A Supplemental Project Agreement for this project was signed by HECO and EPRI on August 8, 2007. The total project funding provided in the Agreement is \$500,000, consisting of \$200,000 in 2007 and \$300,000 in 2008. Under the terms of the Agreement, HECO will be invoiced \$100,000 in 2007, and \$150,000 in 2008. See Attachment 5(K) to this Response for a copy of the executed EPRI Agreement. Now that the Agreement has been signed, EPRI will invoice HECO for \$100,000 co-funding, and HECO will pay the invoice before the end of 2007.

The total budget for this project covering 2007 and 2008 activities is estimated at \$500,000. By signing this Agreement, HECO will obtain \$250,000 in EPRI funds--\$100,000 in 2007-and \$150,000 in 2008.

This project is in line with state policies favoring the development and use of biofuels. Act 159, passed by the 2007 Hawaii State Legislature, has the stated purpose to encourage further production and use of biofuels in Hawaii, establishes that biofuel processing facilities in Hawaii are a permitted use in designated agricultural districts and establishes a program with the Hawaii Department of Agriculture to encourage the production in Hawaii of energy feedstock (i.e., raw materials for biofuels). Act 159, signed June 8, 2007; effective July 1, 2007. The 2007 Hawaii State Legislature also passed a measure which requires Hawaii Department of Business, Economic Development, and Tourism to develop and prepare a bioenergy master plan that sets the course for the coordination and implementation of policies and procedures to develop a bioenergy industry in Hawaii. The primary objective of the bioenergy master plan shall develop a Hawaii renewable biofuels program to manage the State's transition to energy self-sufficiency based in part on biofuels for power generation and transportation. Act 253, signed June 5, 2007; effective July 1, 2007.

Electronic Shock Absorber

The Electronic Shock Absorber (ESA) is the first-of-a-kind demonstration unit developed from idea, patent approval, to design, procurement and construction of a demonstration unit dealing with wind integration issues. As part of the project plan, an ESA demonstration unit was designed, built and tested on a modular test bed. After the shakedown period, the ESA demonstration unit operated and performed successfully as designed in smoothing the wind farm signal to the electrical grid at the Lalamilo substation. Following the successful testing of this

demonstration unit, HECO has plans to use the ESA funds monies in 2007 which included a number of options, such as updating the ESA unit controller and software, increase the storage capacity of the ultracapacitors, examine other ultraccapacitor designs, relocate the ESA trailer to Maui where wind penetration issues surfaced with the installation of the Kaheawa 30 MW wind farm.

Unfortunately, the ESA demonstration unit was damaged by the October 15, 2006 earthquake that originated off the western coast of the Big Island. A team inspected and assessed the damage to the ESA unit. HECO's responses to CA-IR-183, CA-IR-341 and CA-IR-245 provide updates regarding the ESA. The damage to the ESA trailer was a total loss and thus plans for the next phase of testing of the ESA trailer in 2007 was lost.

Since the submittal of those responses, HECO reviewed the ESA damage and disposal report. HECO Environmental has developed an RFP for the disposal of the ESA trailer and its contents which contain hazardous material from the ultracapacitors. See Attachment 5(L) to this Response. The disposal of this hazardous material requires incineration at a certified facility. This hazardous material will likely have to removed, packaged and shipped to the mainland for final disposal.

HECO has sent the RFP to two vendors. It provides that field work will begin in late Summer or Fall and be completed by Dec. 31, 2007. On August 7, 2007, HECO Environmental personnel were provided bid information from one vendor that had proposed to dispose of the ESA Trailer for \$19,600. Environmental personnel were provided an informal bid estimate from the second vendor on August 9, 2007 for \$34,000. HECO anticipates announcing the winning bid on August 24, 2007.

HECO worked with the Hawaii Natural Energy Institute (HNEI) at the University of Hawaii on securing federal funds from the U. S. Department of Energy ("USDOE") for a multi-year-project-to examine technologies (i.e., ESA; battery energy storage, etc.) that can help ameliorate the issues (power fluctuation issues, frequency, etc. arising from wind generation) related to wind energy integration on an electric utility grid. The intent is to use ESA budget monies and utility resources as cost-share to leverage federal dollars to build and test an ESA and other energy storage devices (e.g., battery energy storage systems) at a commercial wind farm facility on the islands. See HECO's response to CA-IR-183.

HNEI has submitted a proposal to USDOE for federal funding. The proposal was developed jointly by HECO and Maui Electric Company ("MECO"), in partnership with HNEI, General Electric Company, and others, in response to Program Area of Interest 2: Renewable and Distributed Systems Integration (DE-PS26-07NT43119-02). USDOE anticipates notifying applicants selected for negotiations in early November 2007, and anticipates making awards by the end of March 2008. See HECO's response to CA-IR-341, Attachment 1.

In the event this proposal is not funded, HECO and MECO will continue to pursue development of a new ESA on Maui while working with HNEI and other organizations to seek external funds towards ESA-related work. These efforts would occur in 2008 and beyond. See HECO's responses to CA-IR-183 and CA-IR-341. In a letter to HNEI dated July 20, 2007, HECO stated that it "will spend up to \$221,000 in ESA R&D in each of the years 2008-2010, and will provide part or all of this as cost share." See Attachment 5(M) to this Response for a copy of that letter.

Recurring renewable energy funds

The 2007 test year estimate includes the following for recurring renewable energy seed monies: \$50,000 recurring renewable research and development--seed monies for general renewable energy, new technologies, studies, assessment, etc.; and \$15,000 for recurring renewable energy memberships, travel and publications.

In HECO's response to CA-IR-407, Attachment 1, actual spending for Recurring Renewable Energy Funds as of June 2007 totaled \$4,786. After the IR response was submitted, a mischarge was noted and corrected. The net actual expenses, as corrected, as of July 31, 2007 are approximately \$15,788.

HNEI of the University of Hawaii at Manoa has been contracted by HECO to evaluate, document, repair, and maintain data acquisition systems of photovoltaic systems installed under the Sun Power for Schools program as well as systems located at military and other sites. The primary objective of this project is to maintain remote logging and collection of data generated by photovoltaic systems to enhance the educational value for the schools and general public. To achieve this objective, HNEI will develop and document troubleshooting procedures, validate system operations of internet-based data acquisition systems, and evaluate, repair, and upgrade existing telephone-based data acquisition systems. This project builds upon the partnership between HECO and the University of Hawaii in furthering the demonstration and educational aspects of advanced technologies.

See Attachment 5(O) to this Response for a copy of the executed agreement between HECO and Hawaii Natural Energy Institute for \$30,000. There is a \$10,000 per quarter billing cap in the Agreement, therefore, HECO anticipates being billed up to approximately \$20,000 in 2007.

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Supplemental Project Agreement

Project Title: Agreement, Funder and Project Numbers: This Supplemental Project Agreement applies to the Project entitled: "Hawaiian Electric Company Underground Cable Replacement Policy Development". The Parties will reference Supplemental Project Agreement number TC/CF 011859-11156, (Project ID No. 065973) in all correspondence. The terms and conditions of the Master Agreement between the Parties dated January 3, 2007 are incorporated herein and govern all Work hereunder. Any Purchase Order issued by Member pursuant to this Agreement is solely for Member's internal accounting requirements and, as such, the terms and conditions of such Purchase Order are superseded by the terms and conditions set forth in this Agreement.

Contact Information:

Contact	Name	Phone/Fax	Email
EPRI Project Manager:	Jeremy Bloom	650-855-2796 / 2511	jbloom@epri.com
EPRI Contracts:	Josephine M. Erickson	650-855-2003	jerickson@epri.com
EPRI Sector Account Executive:	Ivo Hug	650-855-8518	ihug@epri.com
Member Contracts	Arthur Seki,	808-543-7987 / 1581	arthur.seki@heco.com
Member Project Manager:	Dean Mizumura	808-543-7041	dean.mizumura@heco.com

Project Funding in U.S. Dollars:

Funding Year	-2007-	-2008-	-2009-	-2010-	TOTAL
Funder Cofunding	\$145,000				\$145,000
Funder TC Funds	\$27,500				\$27,500
EPRI TC Match	\$27,500				\$27,500
Total U.S. Dollars	\$200,000				\$200,000

ited herein by reference.

4.	Project Objectives, Tasks	and Deliverables: See Attached Exhibit 1, incorporated
5.	Involcing:	
	Current year payment en	closed (This form is the invoice for the current year).
	Address invoices to:	Arthur Seki, , Director of Technology Hawaiian Electric Company, Inc. 820 Ward Ave (M/S WA3-YP) Honolulu, HI 96814-2109
	Phone/Fax: E-mail:	808-543-7987 / 1581 Arthur.Seki@heco.com

HECO T-6 ATTACHMENT 5 (A) PAGE 2 OF 5 AUGUST 2007 SUPPLEMENT HAWAIIAN ELECTRIC COMPANY, INC.

IN WITNESS WHEREOF, the parties hereto have caused this Supplemental Project Agreement to be executed by their duly authorized representatives.

Approval / Hawaiian Electric Company, Inc.	Approval / ELECTRIC POWER RESEARCH INSTITUTE, INC.
820 Ward Ave (MS WA3-YP)	Post Office Box 10412
Honolulu, HI 96814-2109	3420 Hillview Avenue
Phone/Fax: 808-543-7987 / 1581	Palo Alto, Ca 94303
	Phone/Fax: 650-855-2003 / 1032
N 200	
Signature Short Age	Signature: Josephin My
Name:	Name: Josephine M. Erickson, Revenue Contracts Negotiator
Title:	Title: // Revenue Contract Negotiator
Date:	Date: // July 10 2007
ENDORSEMENT : EPRI is hereby authorized to release Tailo	red Collaboration Matching Funds from the account of the Hawaiian
ELECTRIC COMPANY, INC. as set forth in this Agreement.	
or By: AMMU Joh	7/9/07
Arthur Seki, , Director of Technology	Date

Exhibit 1

To

Supplemental Project Agreement

TC/CF 011859-11156 (Project ID No. 065973)

"Hawaiian Electric Company Underground Cable Replacement Policy Development"

1. Introduction & Background

The electric delivery infrastructure in many systems has been in service for nearly its design life, and even beyond. In particular, many companies face substantial future costs to replace aging underground distribution cables. Yet today, utility decisions are made under stringent expense controls, limited capital, and increased public concern about reliability. These factors combine to make well-informed decision-making more crucial and yet more elusive than ever. EPRI's Aging Assets research can help by identifying the most economic strategies for dealing with testing, repair, and replacement of underground cables.

EPRI is developing and proving a methodology and supporting software tools for tackling these issues. This methodology fully accounts for the utility's business goals, cost of capital, availability of maintenance budget, and risk tolerance to provide optimal life-cycle strategies for maintaining and replacing underground cable assets. The underlying logic of the EPRI Aging Asset methodology is a dynamic optimization model that has evolved from extensive industrial applications and fundamental operations research principles.

In this project, EPRI will work with HECO to review, adapt, and apply EPRI's methodology for underground cable replacement policy, using EPRI's decision model to assist HECO in developing a test/repair/replace strategy. The research question addressed is "How can a utility plan for cost effective cable replacements while maintaining reliability?" This project continues to develop and apply methods to manage aging infrastructure assets. In particular, the project will produce lessons learned from a utility case study that will be applicable to many utilities implementing processes for managing aging equipment. The project will also advance the state of the art in modeling cable degradation and failure.

The EPRI Aging Asset methodology develops a specific decision strategy for the participant to manage specific asset groups (underground cables, in this case). The strategy provides a clear set of conditions for when to repair and when to replace an asset, when and how to apply diagnostic tests, and what action to take based on the test results. The economic justification for the strategy will be quantified. The strategy includes 1) an operating procedure the utility can use to guide field personnel when confronted with repair or replace decisions, 2) an asset inspection and testing plan, and 3) a tool to quantify risks of equipment failures that may be used in financial planning decisions. When this project concludes, HECO will have

- A thorough understanding of the EPRI's aging assets analysis methodology
- Trained staff people capable of using it
- EPRI software and data for modeling repair/replace decisions for underground cables
- A report documenting the findings and lessons learned

2. Objectives

To recommend cost-effective policies for managing aging underground cables and to further develop methodology for making such recommendations.



3. Scope of Work/Task Descriptions

The scope of this contract/amendment includes the following tasks; (1) Project Kick-Off, (2) Detailed Specification of the Problem, (3) Data Gathering and Analysis, (4) Policy Development, Sensitivity Analysis, and Testing, (5) Final Report and Technology Transfer.

3.1. Task 1: Project Kick-Off

EPRI will hold kickoff meeting and webcast, with HECO to address the following items:

- · Review project objectives and work plan
- Tutorial on the EPRI aging assets analysis methodology
- Preliminary discussion of problem formulation

HECO is expected to designate one or more staff members to work with the EPRI team throughout the project and to designate an executive sponsor to oversee the project. HECO resources needed will be about 250 man-hours to gather data, provide support, and attend meetings and training.

3.2. Task 2: Detailed Specification of the Problem

The EPRI project team and the participants will work together to review the methods, assumptions and data requirements of the decision problem to be solved. This task will conducted via webcasts or conference calls. Aspects of the problem formulation to be addressed include:

- · Cable deterioration modes and hazard rates
- Inspection and testing options and possible outcomes
- · Maintenance, repair, and replacement alternatives
- Costs
- Other uncertainties

EPRI expects to make use of its considerable experience with this problem to guide the discussion.

The EPRI project team will provide EPRI's decision model for underground cable replacement, including the following aspects

- Objective function
- Decision timing
- · Asset condition description
- Test result description

The EPRI project team will present the model for discussion with the HECO participants in a webcast. The webcast will include a tutorial session on the model logic and analysis methods.

3.3. Task 3: Data Gathering and Analysis

The EPRI project team will assist HECO staff in gathering the data needed for the decision model. Items to be addressed in this task include:

- Identification of required data
- Application of industry data (failure rate elicitation)
- Application of company-specific data (e.g., costs)

An EPRI staff member will work on-site with the HECO staff to identify and collect the necessary data. This task will also include conference calls or webcasts as necessary between the EPRI project team and HECO staff.

3.4. Task 4: Policy Development, Sensitivity Analysis, and Testing

The EPRI project team will perform analysis with the decision model to develop test/repair/replace policy recommendations for underground cables. The results of this task will be reviewed with HECO in a webcast or conference call. Items to be addressed in this task include:

- · Inspection and testing strategy using base case assumptions
- · Maintenance, repair, and replacement strategy using base case assumptions

The EPRI project team will work with HECO to test the model to ensure it provides reasonable results for HECO. Testing will include sensitivity analysis to determine the sensitivity of the policy recommendations and costs to the model parameters and will identify those parameters for which more precise estimates would have a significant impact on the results. The results of this task will be reviewed with HECO in a webcast or conference call.

3.5. Task 5: Final Report and Technology Transfer

The EPRI project team will document the model methodology, input data, policy recommendations, sensitivity analysis, and lessons learned in a final report for publication as an EPRI technical report. The non-proprietary results of this work will be incorporated into EPRI R&D program 112, Power Delivery Asset Management, and made available to funding members of that program and to the public, for purchase or otherwise. EPRI will respect the confidentiality of HECO's proprietary information in a manner that is mutually acceptable. HECO will have the opportunity to review the draft final report.

The EPRI team will train HECO staff in using the model and performing the analysis in a webcast. EPRI will present the final results in a closing webcast or on-site meeting at HECO's option.

4. Deliverables

- Cable Population Asset Management and Testing Model
- Draft Final Report
- Final Report

5. Schedule

Task Description	Completion Date
Task 1: Project Kick-Off	June 21, 2007
Task 2: Detailed Specification of the Problem	July 31, 2007
Task 3: Data Gathering and Analysis	August 31, 2007
Task 4: Policy Development, Sensitivity Analysis, and Testing	October 15, 2007
Task 5: Final Report and Technology Transfer	November 15, 2007



Supplemental Project Agreement

1. Project Title: Agreement, Funder and Project Numbers: This Supplemental Project Agreement applies to the Project entitled: "Demand Control Ventilation Demonstration". The Parties will reference Supplemental Project Agreement number TC/CF 011920-11156, (Project ID No. 66014) in all correspondence. The terms and conditions of the Master Agreement between the Parties dated January 3, 2007 are incorporated herein and govern all Work hereunder. Any Purchase Order issued by Member pursuant to this Agreement is solely for Member's internal accounting requirements and, as such, the terms and conditions of such Purchase Order are superseded by the terms and conditions set forth in this Agreement.

2. Contact Information:

Contact	Name	Phone/Fax	Email
EPRI Project Manager:	K. A. Amarnath	650-855-1007 / 2002	aamamath@eprl.com
EPRI Contracts:	Josephine M. Erickson	650-855-2003 / 1032	jerickson@epri.com
EPRI Sector Account Executive:	Ivo Hug	650-855-8518	ihug@epri.com
Member Contracts	Arthur Sekl	808-543-7987 / 1581	arthur.seki@heco.com
Member Project Manager:	Linda Koyanagi	808-543-4720 / 4697	linda.koyanagi@heco.com

3. Project Funding in U.S. Dollars:

Funding Year	-2007-	-2008-	-2009-	-2010-	TOTAL
Funder Columbing	\$18,500				\$18,500
Funder TC Funds	\$29,200				\$29,200
EPRI TC Match	\$29,200			·	\$29,200
Total U.S. Dollars	\$76,900				\$78,900

4. Project Objectives, Tasks and Deliverables: See Attached Exhibit 1, incorporated herein by reference.

The equipment purchased under this agreement is expected to have little to no residual value at the end of the project. Funder (HECO) may, at its option, pay fair market value at the end of the period of performance to purchase the equipment. Alternatively, EPRI may, at its option, abandon the equipment in place.

 Invoicing: Funder will be invoiced for \$29,200, the balance of the Funds, \$18,500 are being paid out of Funder's deposit account

Current year payment enclosed (This form is the invoice for the current year	\Box	Current year navmen	t enclosed (This	form is the invoice	for the current year
--	--------	---------------------	------------------	---------------------	----------------------

Address invoices to: Arthur Seki, , Director of Technology Hawaiian Electric Company, Inc.

820 Ward Ave (M/S WA4-NR)

Honolulu, HI 96840

Phone/Fax: 808-543-7987 / 7099 E-mail: Arthur.Seki@heco.com

HECO T-6 ATTACHMENT 5 (B) PAGE 2 OF 5 AUGUST 2007 SUPPLEMENT HAWAIIAN ELECTRIC COMPANY, INC.

IN WITNESS WHEREOF, the parties hereto have caused this Supplemental Project Agreement to be executed by their duly authorized representatives.

Approval / Hawaiian Electric Company, Inc.	Approval / ELECTRIC POWER RESEARCH INSTITUTE, INC.
P.O. Box 2750 (M/S CP10-1W)	Post Office Box 10412
Honolulu, HI 96840	3420 Hillview Avenue
Phone/Fax: 808-543-4794 / 4697	Palo Aito, Ca 94303
}	Phone/Fax: 650-855-2003 / 1032
Signature: Maddle Mille	Signature: Areshin M Circ
Name: David G. Waller	Name: / Josephine M. Erickson,
Title: Vice President, Customer Solutions	Title: // Revenue Contract Negotiator
Date: July 12, 2007	Date: // Luke 16 2007
ENDORSEMENT: EPRI is hereby authorized to release Tailor	ed Collaboration, Matching Funds from the account of the Hawaiian
Electric Company, Inc. as set forth in this Agreement.	
By: NAMMU Sdi	<u> </u>
Arthur Seki, , Director of Technology	Date

HAWAIIAN ELECTRIC COMPANY, INC.

Exhibit 1

To

Supplemental Project Agreement TC/CF 011920-11156 (Project ID No. 66014)

"Demand Control Ventilation Demonstration"

A. Background, Objectives and New Learnings:

Introduction/Background

Conditioning of outside air in a typical commercial air conditioning system accounts for approximately 30% - 40% of the overall cooling load. Standard air conditioning systems are designed with a fixed amount of outside air introduced, with the remainder of the supply air being re-circulated from the space. The quantity of ventilation air required is normally determined by the space design populace. Hence, if a room is designed for a maximum of 100 people, the ventilation provided is based on 100 people even though the population in the space is not normally at a maximum.

Demand Control Ventilation (DCV) is a control strategy whereby the carbon dioxide level in the space is used as an indirect measure of the occupant density, and the ventilation air is modulated in response to the CO₂ levels. The use of a DCV controls strategy can significantly reduce the amount of outside air required for a space, and consequently, the energy use of the air conditioning system. In previous calculations done for the Navy Exchange Building located in Honolulu, based on energy simulation software, the annual kWh usage for DCV systems was estimated at around 60% of standard fixed ventilation systems. It is expected that the use of a DCV system could reduce total air conditioning energy usage by approximately 18% to 25%.

Implementation of a DCV control strategy involves the installation of motorized dampers on air conditioning unit outside air intakes. Additionally, CO₂ sensors are installed in the spaces served by the air conditioning units, and the outside air dampers are controlled via a direct digital control (DDC) system in response to the space CO₂ levels. During periods of lower than design occupancy, the volume of outside air to the space can be reduced while still maintaining an adequate amount of ventilation air to the reduced number of people.

Objectives

The energy savings potential of demand control ventilation in air conditioning systems in Hawaii will be determined, and the accuracy of building energy simulation programs in predicting the energy savings of DCV will be verified.

This project is designed to assist EPRI member utilities in promoting DCV as an energy efficient electro-technology to their commercial customers. Energy efficient DCV technology can benefit customers by lowering their electricity bills, and also helps utilities to reduce demand on the system in a time when generation capacity reserve margins are shrinking. As a part of this project, HECO will be examining the expected cost-to-savings benefit for this technology in Hawaii, and the accuracy of the Trace 700TM energy simulation program in predicting the kWh savings due to DCV implementation.

Ex. 1 - 1

HAWAIIAN ELECTRIC COMPANY, INC.

New Learnings: This project will determine the potential for energy savings in commercial building applications. It will determine if DCV is the appropriate technology to be promoted by EPRI member utilities. The project will also determine the cost effectiveness of DCV technology.

Benefit to the Public: Commercial building owners and operators will benefit from understanding the value of installing DCV technology in their facilities.

<u>Benefit to the Funder</u>: This project is designed to assist HECO in promoting DCV as an energy efficient electrotechnology to their commercial customers. DCV has the potential to provide significant energy reduction in air conditioning systems; it is not in widespread use in Hawaii and several other states. Energy efficient technologies such as DCV can benefit customers by lowering their electricity bills, and also helps HECO to reduce demand on the system.

B. Tasks;

Task 1: Site Survey:

DCV systems will be installed at a Customer Site. The type of facilities best suited to DCV would be those where there is a large occupancy swing and a sizeable number of operational hours, such as retail stores or supermarkets. Baseline CO₂ monitoring of the customer facility will be done to determine the normal occupancy load curve.

A site survey is needed to determine the specific equipment required to retrofit the existing AHU systems for DCV and monitoring.

Task 2: Preparation of Design Plan (including data-logging plan)

Drawings and specifications will be prepared to obtain construction price quotes and for use by installation Contractors.

Task 3: Computer Modeling of DCV systems

A building energy simulation model for the existing air conditioning systems will be created to predict the kWh savings due to the implementation of DCV. The modeling results will be compared against the actual results of the project. The Trace 700TM software program will be used for the DCV energy savings simulation.

Task 4: System Procurement, Installation and Commissioning

Installation of new controls hardware will be done as required to implement a DCV strategy, and as required for post monitoring.

Task 5: Post Monitoring and Analysis of HVAC energy usage

Monitoring will be conducted for approximately 3-months to determine the effectiveness of the DCV systems. A brief technical report will be prepared, summarizing the results of the project, including the following:

- 1) Detailed description of the facility
- 2) Building energy simulation DCV savings estimate



HAWAIIAN ELECTRIC COMPANY, INC.

- 3) Description of the methodology used to collect and analyze the data.
- 4) Detailed analysis and explanation of the significant factors impacting the resulting energy savings and outside air reduction.
- 5) Comparison of the actual energy savings against that predicted by the energy simulation modeling software.
- 6) Conclusions on the applicability of the results of this demonstration project to other similar facilities in Hawaii.
- 7) Documentation of the building energy simulation modeling.
- 8) Raw monitoring data in electronic format.

The main contractor on this project will be HECO. The utility has extensive capabilities in providing engineering solutions to their customer base, including residential, commercial and industrial customers. HECO will subcontract with appropriate HVAC contractors to install the DCV systems at the Customer site.

- C. <u>Deliverables</u>: The non-proprietary results of this work will be incorporated into EPRI R&D Program 170 Advancing End-Use Energy Efficiency & Technology, and made available to funding members of that program and to the public, for purchase or otherwise.
- D. Estimated Period of Performance / Estimated Schedule;

Selection and contract execution of Sub-Contractor	1 month	(Q2 2007)
Contract execution with Customer	1 month	(Q2 2007)
Installation of new equipment (incl. lead-time)	3 months	(Q3 2007)
Baseline Monitoring	1 month	(Q4 2007)
Implementation of DCV strategy and monitoring	6 months	(Q4 2007 to Q2 2008)
Report preparation	3 months	(O3 2008)

HECO T-6 ATTACHMENT 5 (C) PAGE 1 OF 1 **AUGUST 2007 SUPPLEMENT**

EP00320991 Invoice: INVOICE Invoice Date July 23, 2007 Page:

Please Remit.To:... EPRI-DEPT #1527 PO Box 61000

San Francisco CA 94161

United States

Customer No: Payment Terms: Due Date: Customer Ref:

11156 Net 30

August 22, 2007

Customer:

Hawaiian Electric Co., Inc. Arthur S. Seki M/S WA4-NR

820 Ward Ave

Honolulu HI 96814-2109

United States

AMOUNT DUE:

27,500.00 USD

For billing questions, please call:

650-855-2669

Original

Line	Description	Quantity	UOM	Net Amount
1	65973-TC Hawaiian Electric Company Underground Cable Replacement Policy Development	1.00	EA	27,500.00
2	65973-TC Match Hawaiian Electric Company Underground Cable Replacement Policy Development	1.00	EA	27,500.00
3	Tailored Collaboration Pool for funding year 2007 for EPRI 501c3.	1.00	EA	(27,500.00)
4	65973-CF Hawailan Electric Company Underground Cable Replacement Policy Development	1.00	EA	145,000.00
5	Deposit Account for General Use	1.00	EA	(145,000.00)
			Subtotal:	27,500.00
			AMOUNT DUE:	27,500.00 US

Please wire funds to: Bank of America, New York, NY ABA# 026009593 Acct. No.: 1233954313

SWIFT Address: BOFAUS3N

Tax I.D. # 23-7175375 EPRI is a non-profit United States Corporation. Please include an invoice copy with your remittance.

HECO T-6 ATTACHMENT 5 (D) PAGE 1 OF 1 AUGUST 2007 SUPPLEMENT

EPRI

INVOICE

Invoice: Invoice Date Page: EP00320987 July 23, 2007 1 of 1

Please Remit To: EPRI-DEPT #1527 PO Box 61000 San Francisco CA 94161 United States

Customer No: Payment Terms: Due Date: Customer Ref: 11156 Net 30 August 22, 2007

Customer:

Hawaiian Electric Co., Inc. Arthur S. Seki M/S WA4-NR 820 Ward Ave

Honolulu HI 96814-2109 United States AMOUNT DUE:

29,200.00 USD

For billing questions, please call:

650-855-2669

Original

Line	Description	Quantity	UOM	Net Amount
1	66014-TC Demand Control Ventilation Demonstration	1.00	EA	29,200.00
2	68014-TC Match Demand Control Ventilation Demonstration	1.00	EA	29,200.00
3	Tailored Collaboration Pool for funding year 2007 for EPRI 501c3.	1.00	EA	(29,200.00)
•	66014-CF Demand Control Ventilation Demonstration	1.00	EA	18,500.00
5	Deposit Account for General Use	1.00	EA	(18,500.00)
			Subtotal:	29,200.00
			AMOUNT DUE:	29,200.00 US

Please wire funds to:
Bank of America, New York, NY
ABA# 026009593
Acet No.: 1233054313

Acct. No.: 1233954313 SWIFT Address: BOFAUS3N Tax I.D. # 23-7175375
EPRI is a non-profit United States Corporation.
Please include an invoice copy with your remittance.

HECO T-6 ATTACHMENT 5 (E) PAGE 1 OF 6 AUGUST 2007 SUPPLEMENT

Hawaiian Electric Company Inc.

P.O. Box 2750 S Honolulu, HI 96840-0001 Phone (808) 543-4746 Fax (808) 543-4747 Lic # ABC 8494

To:	3420 Hillvi	Electric Power Research Institute, Inc. 3420 Hillview Avenue Palo Alto, CA 94304-1338 Date: Contract No: Project:		August 10, 2007 TC 012117-11156 Demand Monitoring and Response Applications					
Attn:			epe) Erickson ts Negotiator				. Ipp		
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0	Shop Drawin Copy of lette	-	Specifications Samples		Plans Change	Order Pro	posal	•	nt Request e Order Acceptance ment
Copi		Descript							
2 set	7/9/07		ental Project A	xgreem e	nt (Exec	итеа)			
These	are Transmit	tted as chec	ked below:						
	For approval For your use As requested		Approved as a Approved as a Returned for c For review and	oted orrection	: 0 : 1	Resubmit Submit Return	- - -	coj	pies for approval pies for distribution rected prints
		it has been	fully executed	, please :	forward	a set of t	he origin	al agreem	ent document to
Maili	ng Address:	P.O. Box Honolulu	ı, Hawaii 9684 ı: Tracy Yama	0-0001	ic.	Ã.	٠. ا	* Clan	ne h
Сору	Perez/		r Seki/Carlos i/Darren Ishim	ura	Signe	d: Tra	cy W. L. tracts Ac	Yamamote Iministrate)))
Phon	e:	Fa	x:		Phone	e: 543-	4646	Fax:	543-4697

Transmittal



Supplemental Project Agreement

1. Project Title: Agreement, Funder and Project Numbers: This Supplemental Project Agreement applies to the Project entitled: "Demand Monitoring and Response Applications". The Parties will reference Supplemental Project Agreement number TC 012117-11156 (Project ID No. 066197) in all correspondence. The terms and conditions of the Master Agreement between the Parties dated January 3, 2007 are incorporated herein and govern all Work hereunder. Any Purchase Order issued by Member pursuant to this Agreement is solely for Member's internal accounting requirements and, as such, the terms and conditions of such Purchase Order are superseded by the terms and conditions set forth in this Agreement.

2. Contact Information:

Contact	Name	Phone/Fax	Email
EPRI Project Manager:	Douglas Dorr	407-566-8355	ddorr@epri.com
EPRI Contracts:	Josephine M. Erickson	650-855-2003 / 1032	Jerickson@epri.com
EPRI Sector Account Executive:	Ivo Hug	650-855-8518	ihug@eprl.com
Member Contracts	Arthur Seki,	808-543-7987 / 203-1581	arthur.seki@heco.com
Member Project Manager:	Reid Sasaki	808-543-4754	reid.sasakl@heco.com

3. Project Funding in U.S. Dollars:

Funding Year	-2007-	2008 2009 2010	TOTAL
Funder TC Funds	\$47,500		\$47,500
EPRI TC Match	\$47,500		\$47,500
Total U.S. Dollars	\$95,000		\$95,000

4. Project Objectives, Tasks and Deliverables: See Attached Exhibit 1, incorporated herein by reference.

5	Inv	nici	Ina:

Current year payment enclosed (This form is the invoice for the current year).

Address invoices to:

Arthur Seki, Director of Technology Hawaiian Electric Company, Inc. 820 Ward Ave (M/S WA4-NR) Honolulu, HI 96840-0001

Phone/Fax:

808-543-7987 / 808-203-1581

E-mail:

Arthur.Seki@heco.com

HECO T-6 ATTACHMENT 5 (E) PAGE 3 OF 6 AUGUST 2007 SUPPLEMENT

HAWAIIAN ELECTRIC COMPANY, INC.

IN WITNESS WHEREOF, the parties hereto have caused this Supplemental Project Agreement to be executed by their duly authorized representatives.

Approval / Hawaiian Electric Company, Inc.	Approval / Electric Power Research Institute, Inc.				
P.O. Box 2750 (M/S CP10-1W)	Post Office Box 10412				
Honolulu, HI 96840	3420 Hillvlew Avenue				
Phone/Fax: 808-543-4794 / 4697	Palo Alto, Ca 94303				
1	Phone/Fax: 650-855-2003 / 1032				
Signature: 201 Au Muller Name: David G. Waller Title: Vice President, Customer Solutions Date: August 9, 2007	Signature: Name: Josephine M. Erickson, Title: Revenue Contract Negotiator Date:				
ENDORSEMENT: EPRI is hereby authorized to release Ta	ilored Collaboration Matching Funds from the account of the Hawaiian				
Electric Company, Inc. as set forth in this Agreement.					
By: MAMUSL	August 9, 2007				
Arthur Seki, Director of Technology	Date				

Exhibit 1

То

Supplemental Project Agreement TC 012117-11156 (Project ID No. 066197)

"Demand Monitoring and Response Applications"

A. Background, Objectives and New Learnings:

Energy efficient technologies linked to smart communications and control networks allow consumer participation in expanded utility services, and a prices-to-devicesSM approach that enables end-use equipment to respond to price or emergency signals from a utility, based on consumer preferences on cost, comfort, convenience, carbon footprint, and other variables. The Electric Power Research Institute and its members collaborate on research and development to improve the efficiency and integration of electricity delivery systems and the end-use equipment in homes, offices, and factories. When energy efficiency is augmented with demand response and load management it is one of the most cost effective means of addressing higher fuel costs, growing demand, and reducing greenhouse gas emissions. Fortunately this requires no major scientific breakthroughs, but it does require the accelerated deployment of technology and a "smart" utility infrastructure.

The objective of this research effort is to better understand how some of the new state of the art technologies may fit into the long range solutions to HECO's need for energy saving opportunities.

Successful project results will allow HECO to make more informed recommendations to their customers when the requests for accurate information about energy savings products come in from those customers. This in turn is additionally the benefit for HECO and HECO's customers.

- B. <u>Tasks</u>: There are two intended tasks for this work as follows:
 - Task 1. Evaluation of Retrofit Energy Savings Devices
 - Task 2, Evaluation of Retrofit Electronic Ballasts for HID lighting

Full detail on these two tasks is supplied in Attachment A.

- C. <u>Deliverables</u>: The non-proprietary results of this work will be incorporated into EPRI R&D program [170] Energy Efficiency Initiative Research, and made available to funding members of that program and to the public, for purchase or otherwise.
- D. <u>Estimated Period of Performance / Estimated Schedule</u>: The entire period of performance is anticipated to be August 2007 to March 2009. A more defined schedule shall be developed as part of the project kickoff meeting.
- E. Other Funders / Funder Obligations: The Funder's obligations for this project will be to provide access to a site for installation of the electronic HID ballasts and to supply a prioritization input on the retrofit energy savings devices for evaluation.

Attachment A - Detailed Task Descriptions

Task 1 Evaluation of Retrofit Energy Savings Devices:

This task effort is designed to undertake definitive and careful technical evaluation of a representative number of retrofit energy-saving technologies to form an unbiased and rigorous knowledgebase by which the buying public could make informed decisions. This project will involve careful selection of technologies for evaluation, sites for that evaluation, protocols for conducting the evaluation, and presentation of the results in a form that will be useable by consumers. The effort will consist of four separate subtasks intended to quantify and then articulate the research results as follows:

Task 1-A – Select the Candidate Technologies for Evaluation: This task will survey the wide array of potential technologies for evaluation and develop a candidate list. Emphasis will likely be highest on those technologies making significant energy-savings claims. HECO will provide to EPRI a prioritized list of the technologies they would be most interested in testing. As a minimum, the top technology on the HECO list shall be selected for testing. In addition, at least one tested technology will be a Voltage Regulation Device. The others on the list will be tested based on popularity with the other sponsors and total project funding.

Task 1-B – Develop Testing Protocols and Procedures for Each Technology Type: It is likely that the set of Task 1 devices chosen for test will comprise a variety of technologies. It is also expected that each technology type will require some unique testing methods, venues. etc. Essential to a rigorous testing and results, considerable attention will be paid to ensuring that each technology that is selected for testing is tested in an unbiased and fair manner.

Task 1-C - Testing of Selected Technologies: Rigorous testing and evaluation of each technology will be performed under the protocols and methods defined by Task 1-B above. The technologies selected for testing by HECO will be evaluated in both laboratory and field environments, in an effort to characterize the technology's performance under controlled and "real-life" conditions.

Task 1-D – Prepare Final Report and Transfer Technology: The results of this effort will be definitive and unambiguous assessments of the energy savings capabilities of the selected technologies - something currently unavailable in the marketplace. By informing the purchase decision, these evaluations will allow the marketplace to behave rationally, creating a level playing field in which truly innovative and cost-effective technologies can flourish, while those that are less so can find their appropriate market niches. This facilitates creation of an environment where purchasers of technologies will decide what energy-savings technologies are most likely to produce the best return for the investment dollar.

The final report will also include:

- 1.A detailed description of the retrofit energy-saving device marketplace (focusing on the types of technologies and techniques often employed in products offered in this area) and a candid assessment of the energy-savings mechanisms that are commonly invoked, along with their likely potential for significant energy savings;
- 2.A detailed description of the objectives and methods of the testing, including development of protocols, selection methods, testing methods. etc.;
- 3. Detailed results and analysis of the device tests, including rigorous interpretation of energy savings results and potential; and,

4. The report will also provide a recommended strategy for prospective purchasers of retrofit energy-saving devices to more rigorously assess the claims made by the marketers of such technologies and to assess the likely benefits, if any – that applying such technologies may offer.

Data that is proprietary or confidential may be omitted from the published report if sources do not allow its publication. All sources of data used in the analysis, whether published or not, will he cited in the report following generally accepted guidelines for publications in the trade.

Task 2 High-Efficiency Universal Electronic Ballast for High Intensity Discharge (HID) Lighting Demonstration

This task work will be implemented to document the power quality and the electrical energy performance of new dimmable electronic ballast technology for High Intensity Discharge (HID) lighting applications through a technical demonstration at a commercial or industrial site, The effort will consist of five separate subtasks intended to quantify and then articulate the research results as follows:

Task 2-A – Identification of Candidate Site: This task will require time support from HECO and the EPRI project team to insure that the candidate site meets the selection criteria defined in attached selection criteria document. HECO responsibilities will involve the prescreening of candidate sites and support with site meetings and information gathering. The EPRI team will be responsible for evaluating all of the information in support of meeting the project goals and specifications.

Task 2-B - Procurement and Installation of Lighting Fixtures, Lamps, and Monitoring Equipment: This task will be supported by HECO for the installation and installation supervision and supported by EPRI for the equipment costs. EPRI will provide the lighting fixtures (including ballasts) and lamps and will include costs associated with the installation of the lighting fixtures and lamps. EPRI will provide 24 new 400 watt metal halide lighting fixtures, fitted with dimmable electronic HID ballast and pulse start metal halide lamps, to retrofit three (3) complete 277V lighting circuits. EPRI will also provide four (4) on-site spare ballasts and four (4) on-site spare lamps. EPRI will also cover costs associated with the replacement of faulty ballasts and/or lamps during the six month demonstration period. After the six month demonstration project is complete, the demonstration site owner/occupier will be allowed to keep the provided fixtures, ballasts, and lamps (installed and spares) at no cost. EPRI will provide the monitoring equipment for up to six months.

Task 2-C - Field Measurements and Remote Monitoring Data Downloads: This task will be supported by HECO for the physical resets and maintenance of the monitoring equipment during the six month demonstration and supported by EPRI for the associated monitoring communications costs.

Task 2-D - Laboratory Testing for Comparisons to Field Data: This task will be performed at the EPRI PQ and DER test facility in Knoxville, TN in the using the light chamber instrumentation. The objective is to test some of the old ballasts that are replaced and compare these to the new electronic ballasts under controlled conditions where efficiency and efficacy can be evaluated.

Task 2-E – Website Development and Hosting: The main focus of this task will involve development and hosting of the project website. All information about the site and the site data shall reside on the collaborative website and have both public and password protected areas.

HECO

Exhibit 1 Supplemental Opportunity Funding Agreement

"Failure Assessment of Fargo Compression Dead end Grip"

Statement of Work

A compression dead end grip on Hawaiian Electric's Waiau-Ewa Nui #2 138 kV transmission line failed recently and another one a few years earlier. Preliminary investigations conducted by Hawaiian Electric indicated that the probable cause of failure was either from a design flaw or from repetitive expansion and contraction of the jumper loop that was connected to the grip. Detail investigations are required to determine the exact cause of failure so that proper remedial action can be taken to avoid future incidences. This Statement of Work provides a description of the work that is required to perform a failure assessment of the compression dead end grips.

Through failure investigations performed on similar failed compression grips over the years by EPRI, it was found that the probable cause of failure of compression grips can cover a wide range of driving influences. Some failure mechanisms are initiated at installation by a variety of poor installation techniques. Other driving forces are attributed to aspects of their service life, some of which have a coupled relationship to initial installation practices. Other causes could be failures from mechanical and thermal fatigues.

The failure investigation will use a variety of visual, metallurgical and other laboratory assessment tools to assess probable failure mechanism and root cause. By comparing the attributes of the failed units versus the attributes of those that has seen the same exposure and service-life but survived, additional failure mechanism insight can be derived and an inspection protocol recommended to assess the in service units.

A. Objectives:

The objectives of this research are:

- 1. Determine the cause(s) for the compression dead end grips to fail while in service
- 2. Provide guidance to direct an appropriate response by Hawaiian Electric Company (HECO) to determine the reliability and capability of the remaining units in service on the subject line to maintain their line availability status
- 3. Recommend remedial action to be taken to avoid future failures

B. Tasks:

Metallurgy assessment will be performed to characterize the condition of the various components of the fitting, especially in the area of failure and the fillet weld around the compression tube. Whether the steel core, the aluminum sleeve or the tongue was overheated prior to their failure will be determined. Metallic properties for the components of the grip will be determined by Scanning Electron Microscope (SEM), Energy Dispersion Spectroscopy (EDS) and Metallography.

HECO

Locations where material weakness or stress concentrations were formed will be determined. The grain structure of the failed areas will be examined to glean most of this data via SEM and stereo microscopy techniques.

In general, the following tasks will be performed:

- 1. Collect and review documentation from HECO related to the failure
- 2. Examine visually the compression grips and photographic documentation of grips as received
- 3. Perform a battery of suitable tests including tensile strength, bending and torsional ductility, and hardness on the grip materials
- 4. Perform chemical element analysis at the fracture location to assess their mechanical properties
- 5. Determine cause(s) of failure
- 6. Set up and perform tests to simulate failure to verify cause(s)
- 7. Prepare a report of the analysis data and root cause of failure.

C. Deliverables:

A final report with failure assessment documentation including descriptions of various failure mechanisms raised and their appropriate substantiation or rejection-based facts from the assessment protocol will be delivered to HECO. The report will also provide guidance to determine the reliability and capability of the remaining units in service on the subject line to maintain their line availability status, and recommendation of remedial action to be taken to avoid future failures.

D. Period of Performance:

Preliminary draft of the failure mechanism will be completed in 8-12 weeks after contract. HECO will be given two weeks to review and comment, followed by publication of a final report within 2 weeks of receipt of comments.

E. Funding Requested

EPRI TC --\$48,397 <u>HECO cost match -- \$48,397</u> Total -- \$96,794

HECO T-6 ATTACHMENT 5 (G) PAGE 1 OF 3 AUGUST 2007 SUPPLEMENT

UNDERGROUND BEST PRACTICES ASSESSMENT

Draft Statement of Work

INTRODUCTION

The Electric Power Research Institute (EPRI) in combination with the staff of the EPRI Family of Companies showcase years of experience in the areas of engineering and design, system operation and reliability, construction, maintenance optimization, and asset management; including the development and implementation of a number of key processes, tools, and enterprise wide resource programs. These efforts have demonstrated that there are two key factors in creating a successful maintenance optimization and asset management initiative, implementation, and integration. They are:

- Developing an appropriate and sustainable inspection and maintenance management strategy that is responsive to an organization's needs and corporate goals, and
- Obtaining the necessary cross-functional support and participation from maintenance, engineering, construction, operations and management for the implementation of a comprehensive inspection and maintenance program

EPRI has been assisting utilities with the optimization of key components of their asset management and maintenance programs for the past 15 years. Our initiatives have included all aspects of, engineering, design, operational performance, and maintenance; including strategic goal development, risk management, engineering analysis and design, system operation and reliability, and maintenance processes.

The elements of management and work culture, personnel skills and qualifications, human performance factors, and evaluation and implementation of the latest technologies and process methodologies are evaluated in our analysis and assessment. New technology assessment, employment, and integration with 'best practice' inspection and maintenance management processes and tools have been the cornerstone of many EPRI service applications. In each case, this work has focused on both the programmatic and technical aspects of improving the components of asset management, inspection and maintenance management. While focused on the application and integration of inspection and maintenance management processes and tools, EPRI has also been continuously involved in the evaluation and application of "state of the art" transmission, substation and distribution inspection and maintenance management tools and techniques. During this time, EPRI, has developed tools and technologies associated with risk and reliability based strategies for asset management, inspection and maintenance management. Tools for, predictive, proactive, and preventive processes, engineering tools, system analysis and design technologies, have also been developed. These technologies and techniques have been successfully applied over a decade at utilities around the world.

HECO T-6
ATTACHMENT 5 (G)
PAGE 2 OF 3
AUGUST 2007 SUPPLEMENT

BACKGROUND

Underground cabling is a critical component of HECO's energy delivery system. The ability to align HECO with the best practices in the industry with regards to cable installation and maintenance practices will help ensure reliable operations.

OBJECTIVES "

The design and documentation of an organization's maintenance basis for systems and equipment greatly contributes to the integration of preventive and predictive maintenance processes. In this case, HECO's objectives are to continue to improve the organization's predictive and preventive maintenance processes and tools as well as to critically look at the organization's current underground design and construction standards and practices. Specifically the objectives are:

- To perform and assess HECO's underground installation and maintenance practices.
- To conduct a comprehensive underground technology workshop to raise the level of awareness of the state of the art and 'best practices' as well as to identify opportunities for improvement;

Underground Field Assessment

An industry expert who shall accompany HECO underground field crews to evaluate current installation and maintenance practices shall perform this assessment. This expert shall review our current cable pulling, splicing, fault finding practices and tooling.

Underground Technology Workshop

EPRI will conduct a workshop specifically focused on best practices in the maintenance refurbishment and replacement of underground cables to raise the level of awareness in the organization relative to industry approaches, engineering, state-of-the-art practices and diagnostic technologies. The workshop is to be conducted in Honolulu, HI, and is anticipated to set the overall direction for the cable reliability optimization effort. The results of the workshop will identify the specific data needs and other requirements for this phase. In support of the workshop, EPRI recommends that HECO personnel participate in the selfassessment exercise. Ideally, personnel from Construction & Maintenance, Engineering and System Operations consisting of a diverse mix of management, supervisory, planning, and craft from each of the disciplines would participate to yield optimum results. In the workshop, EPRI will facilitate a number of interactive sessions with HECO personnel. The purpose of these sessions is to communicate EPRI Solutions' vision of Cable Reliability Optimization and, through a number of guided exercises, enable the organization to assess what process and technological improvement opportunities exist and define issues that are likely to negate reasonable and desirable improvement. During the Cable Reliability Optimization selfassessment:

 Subject matter experts will inform HECO on EPRI Cable Reliability Optimization philosophies, processes, technical issues, and proactive strategies

HECO T-6 ATTACHMENT 5 (G) PAGE 3 OF 3 AUGUST 2007 SUPPLEMENT

- The workshop participants will develop a self-assessment to help identify strengths and opportunities, and outline an improvement plan.
- Workshop participants will evaluate organizational goals and define realistic expectations in reliability targets and controllable cost areas.
- A prioritized list of issues that block movement to the "desired" state of process excellence will be developed

The EPRI team will produce a report, based on the self-assessment results, that clearly defines EPRIs' interpretation of the current state of the organization. These results will be utilized in a working session with the HECO workshop participants to develop the specific strategy and draft a plan for the Cable Reliability Optimization (CRO) program initiative. This will include performing any additional analysis and assessment of HECO cable reliability issues required, failure modes and causes, demographics, etc.

Funding Requested

EPRI TC -- \$30,000 <u>HECO cost match -- \$30,000</u> Total -- \$60,000

HECO T-6 ATTACHMENT 5 (H) PAGE 1 OF 1 AUGUST 2007 SUPPLEMENT

T&D INSPECTOR TRAINING

Draft Statement of Work

DESCRIPTION

EPRI has started an on-line training program with photos and descriptions of a limited amount of components on a typical electrical distribution and transmission system. These descriptions are limited to insulators, structures and basic inspection methods and appear to contain the basics of each type of equipment. There is also a test that is associated with the on-line training to measure the knowledge gained from the training. EPRI has talked about expanding the on-line training by including more components and C&M would like to work with EPRI in continuing the development of this training to include both overhead and underground equipment. HECO would also like to work with EPRI in adding some T&D operational type information to the system to help Inspectors see how and why their equipment are used. Other areas of interest are to develop further the information on the AIM research done to enhance the inspections and inspection procedures, as well as the documentations.

BACKGROUND

C&M has an initiative to have qualified inspectors and are creating an inspection training program with a testing procedure which is part of the new job position requirement. HECO C&M will be using the EPRI resources from this project to help create the inspection training program and qualification test. HECO C&M would be interested in sharing the training manual that was created to help improve the EPRI on-line program. HECO currently has young inspectors that could use this type of training and exposure to programs and data that other utilities employ is beneficial. HECO would also like to see if this on-line training can be personalized to the utility's needs.

OBJECTIVES

This program will help to improve the prioritization of work by having a better understanding about the components function and failure mechanism and its importance to the safe operation of the system, which will enable HECO to do the right work at the right time. Having an on-line training program is also very important when justifying the integrity of the inspection program.

<u>Funding Requested</u>

EPRI TC -- \$35,000 <u>HECO cost match -- \$35,000</u> Total -- \$70,000

HECO T-6 ATTACHMENT 5 (I) PAGE 1 OF 1 AUGUST 2007 SUPPLEMENT

From: Watanabe, Colin S CIV USAG HI DPW [mailto:colin.s.watanabe@us.army.mil]

Sent: Thursday, August 09, 2007 11:33 AM

To: Luckett, Stephen

Cc: Keith USAG HI DPW Yamanaka; Colin S USAG HI DPW Watanabe

Subject: Status of Army License to Enter (UNCLASSIFIED)

Classification: **UNCLASSIFIED**

Caveats: NONE

The Army is currently routing the appropriate real estate documents to allow HECO a License to Access. At this time the Army does not anticipate any major obstacles to obtaining the necessary signatures.

Colin S. Watanabe Chief, Utilities Division (808) 656-1410 ext. 1105

Service is our Job! Excellence is our Goal! Your comments are important to us. Logon:

http://ice.disa.mil/index.cfm?fa=card&service provider id=83104&site id=46&service category id=5

Classification: **UNCLASSIFIED**

Caveats: NONE

HECO T-6 ATTACHMENT 5 (J) PAGE 1 OF 2 AUGUST 2007 SUPPLEMENT

DRAFT

Hawaiian Electric Company, Inc.

Exhibit 1

To

Collaborative Funding Agreement

CF xxxxxx-11156 (Project ID No. xxxxx)

"Biodiesel Co-firing in Boiler Testing: Phase 4 – HECO Biofuels Program (Utility Demonstrations)"

Introduction

The use of liquid biofuels (e.g., ethanol and biodiesel) in electric power generating units represents a potential option to increase HECO Utilities' renewable energy portfolio. ("HECO Utilities" herein refers to HECO and its subsidiary utilities HELCO and MECO.) In addition, utilizing biofuels for electric power generation will help HECO meet its Renewable Portfolio Standard (RPS) and reduce its consumption of fossil fuels. The use of biofuels in Hawaii to reduce its dependence on imported fossil fuels is strategy being considered by many public and private stakeholders in a variety of initiatives. However, information and experience regarding the utilization of biofuels in internal combustion engines, combustion turbines, and steam generation boilers to generate electricity is limited. There exists a need to build the utility's knowledge base on biofuels.

Before biofuels can be used on a commercial basis, the technical feasibility and economic viability of firing power generating units with biofuels need to be assessed. The assessment of biofuels, as directed in HECO Utilities' multi-phased Biofuels Program, includes: (1) screening and resource evaluation of biofuels; (2) evaluation of generating unit performance and emissions; (3) investigation of key operational, environmental, and regulatory issues; and (4) demonstration of biofuels in utility power generating units.

HECO Utilities are moving into Phase 4 of its Biofuels Program. Testing of biodiesel in MECO's internal combustion engines and combustion turbines are ongoing and/or planned, and HECO's planned combustion turbine power plant is slated to be fueled with biofuels. To complement these and other efforts, HECO is evaluating biodiesel co-firing with low sulfur fuel oil ("LSFO") in its steam generating units on Oahu.

This document describes the work scope for biodiesel co-firing tests in a HECO boiler.

Objectives

The overall objective of HECO Utilities' biofuels program is to build HECO's knowledge base of biofuel utilization for electric power production in Hawaii so that informed decisions can be made about future full-scale applications. This objective will be achieved by progressing through multiple phases of research, development, and demonstration projects.

The objective of this project (Phase 4) is to demonstrate and gain operational experience of co-firing vegetable oil-based biodiesel with LSFO in a utility boiler/steam turbine generating unit at varying load conditions fired with biodiesel blend levels up to or exceeding 20%.

Scope of Work/Task Description

The use of higher blend levels and longer testing periods compared to tests conducted at NYPA's Poletti power plant is targeted. Research and evaluation of fuel delivery/storage, unit operation and

HECO T-6 ATTACHMENT 5 (J) PAGE 2 OF 2 AUGUST 2007 SUPPLEMENT

DRAFT

Hawaiian Electric Company, Inc.

performance, and emissions will provide HECO with valuable first-hand experience related to biofuels for power generation.

This Phase 4 project will be undertaken in five major tasks: (Execution of these tasks will be dictated by HECO's ongoing project planning, permitting and approval requirements, and funding availability.)

Task 1 - Fuel Compatibility Evaluation

In Task 1, fuel property and viscosity analyses will be conducted to evaluate the compatibility of biodiesel/LSFO blends with existing fuel delivery and handling systems at the host site. Fuel analyses and viscosity-temperature tests of neat LSFO, neat biodiesel, and a series of biodiesel-LSFO blends (e.g., possible range of 5% to 90% biodiesel) will be conducted to characterize fuel properties and flow behaviors (i.e., viscosity vs. temperature). Data from these tests will help formulate the co-firing test plans, including the identification of test limitations and potential equipment modification requirements.

Task 2 - Biodiesel Co-firing Test Plan

Task 2 will consist of developing a test plan for co-firing biodiesel with LSFO in a boiler. Information from Task 1 will be used to identify required equipment modifications and support development of the test matrix. The test plan will identify the fuel blends and volume requirements, fuel delivery/mixing procedures, co-firing system design, boiler operating test points, performance and emissions data, testing protocol and instrumentation, and data reduction methodologies. Environmental issues and permit requirements will also be assessed.

The envisioned testing may include, but not be limited to, measurements of combustion stability, flame stability, boiler performance, fuel system performance, and emissions (e.g., O₂, NO_x, CO, CO₂, SO₂, PM-10, and opacity).

Task 3 - Procurement and Installation

Task 3 includes the procurement of biodiesel fuel, and procurement and installation of fuel system equipment, boiler-related components, sensor and emissions analyzers, and data acquisition system. Information from the test plan developed in Task 2 will be used to guide the procurement and installation tasks.

Task 4 - Shakedown and Testing

In Task 4, equipment and subsystems shakedown will occur. Successful shakedown operations will be followed by co-firing testing and data collection per the test plan developed in Task 2.

Task 5 - Test Data Reduction and Analysis

Task 5 includes the analysis of collected data, formulation of conclusions, and preparation of the final report on co-firing tests.

Deliverables

The deliverables targeted for this project are three reports – one report for Tasks 1, 2, and 5. The final report for Task 5 will include findings of all project tasks.



Supplemental Project Agreement

1. Project Title: Agreement, Funder and Project Numbers: This Supplemental Project Agreement applies to the Project entitled: "Co-Firing in Boiler Testing: Phase 4 HECO Biofuels Program". The Parties will reference Supplemental Project Agreement number CF 012121-11156 (Project ID No. 066202) in all correspondence. The terms and conditions of the Master Agreement between the Parties dated January 3, 2007 are incorporated herein and govern all Work hereunder. Any Purchase Order issued by Member pursuant to this Agreement is solely for Member's internal accounting requirements and, as such, the terms and conditions of such Purchase Order are superseded by the terms and conditions set forth in this Agreement.

2. Contact Information:

Contact	Name	Phone/Fex	Email
EPRI Project Manager:	Anthony Facchiano	650-855-2492	afacchia@epri.com
EPRI Contracts:	Josephine M. Erickson	650-855-2003 / 1032	jerickson@epri.com
EPRI Sector Account Executive:	Richard Menar	650-855-2898	menar@epri.com
Member Contracts	Arthur Seld	808-543-7987 / 808-203-1581	arthur.seki@heco.com
Member Project Manager:	Darren Ishimura	808-543-7817 / 7099	darren ishimura@heco.com

3. Project Funding in U.S. Dollars:

E-mail:

Funding Year	-2007-	-2008-	-20092010-	TOTAL
Funder Cofunding	\$200,000	\$300,000		\$500,000
Total U.S. Dollars	\$200,000	\$300,000		\$500,000

- 4. Project Objectives, Tasks and Deliverables: See Attached Exhibit 1, Incorporated herein by reference.
- Invoicing: Funder will be invoiced \$100,000 in 2007, the balance of \$100,000 will be paid from Funder's deposit account. Funder will be invoiced \$150,000 in 2008, the balance of \$150,000 will be paid from Funder's deposit account.

under's deposit account.	
Current year payment en	closed (This form is the invoice for the current year).
Address Invoices to:	Arthur Sekl, Director of Technology Hawalian Electric Company, Inc. 820 Ward Ave (M/S WA4-NR) Honolulu, Hi 96840-0001
Phone/Fax:	808-543-7987 / 808-203-1581

Arthur.Seki@heco.com

HECO T-6 ATTACHMENT 5 (K) PAGE 2 OF 3 AUGUST 2007 SUPPLEMENT

HAWAIIAN ELECTRIC COMPANY, INC.

IN WITNESS WHEREOF, the parties hereto have caused this Supplemental Project Agreement to be executed by their duly authorized representatives.

Approval / Hawaiian Electric Company, Inc.	Approval / Electric Power Research Institute, Inc.
820 Ward Ave (M/S WA4-NR)	Post Office Box 10412
Honolulu, HI 96840-0001	3420 Hillview Avanue
Phone/Fax: 808-543-7987 / 808-203-1581	Palo Alto, Ca 94303
	Phone/Fax: 650-855-2003 / 1032
Signature: 1014 WWW Name: A Karl Stahlkopf Title: Sr. VP and CTO	Signature: Josephine M. Erickson,
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Name: Josephine M. Erickson, Title: Revenue Contract Negotiator
Date: %-%-07	Date: 08-07
ENDORGENEUR ERRI In hospita sutherhead to release Talle	pred Collaboration Matching Funds from the account of the Hawalian
Electric Company, Inc. as set forth in this Agreement.	ored conductation watering runos from the account of the nawallan
MBy. Withush	8/8/07
Arthur Seld, Director of Technology	

Exhibit 1

To

Supplemental Project Agreement CF 012121-11156 (Project ID No. 066202)

"Co-Firing in Boiler Testing: Phase 4 HECO Biofuels Program"

A. Background and Objectives:

The blending of biofuels in oil-fired electric power generating units represents a potential option to reduce reliance on fossil fuels. However, information and experience regarding the utilization of biofuels in steam generation boilers is limited and consequentially, there exists a need to build the knowledge base. Before oil / biofuel co-firing can be utilized on a commercial basis, the technical and economic viability needs to be assessed. This assessment needs to include: (1) screening and resource evaluation of various biofuel options; (2) evaluation of generating unit performance and emissions; (3) investigation of key operational, environmental, and regulatory issues; and (4) demonstration of biofuels in utility power generating units.

The objective of this project is to demonstrate and gain operational experience of co-firing vegetable oil-based biodiesel with Low Sulfur Fuel Oil (LSFO) at HECo's steam generating units on Oahu. The use of higher blend levels and longer testing periods compared to tests conducted at NYPA's Poletti power plant is targeted. Research and evaluation of fuel delivery/storage, unit operation and performance, and emissions will provide the power industry with valuable first-hand experience related to biofuels for power generation.

B. Tasks:

Towards meeting the above objectives, five major tasks are planned:

- Task 1 Puel Compatibility Evaluation
- Task 2 Biodiesel Co-firing Test Plan
- Task 3 Design, Procurement and Installation
- Task 4 Shakedown and Testing
- Task 5 Test Data Reduction and Analysis

These tasks will be further defined by HECo and EPRI as the project moves forward.

C. <u>Deliverables</u>: The non-proprietary results of this work will be incorporated into EPRI R&D program P71, Combustion Performance and NOx Control, and made available to funding members of that program and to the public, for purchase or otherwise.

The deliverables targeted for this project are reports for each task. The final report for Task 5 will include findings of all project tasks.

D. <u>Estimated Period of Performance / Estimated Schedule</u>: The project is scheduled to start in September, 2007 and continue through to September 2008. The schedule for 2008 will be determined at a later date.

HECO T-6 ATTACHMENT 5 (L) PAGE 1 OF 39 AUGUST 2007 SUPPLEMENT

Request for Proposal HECO Electronic Shock Absorber Trailer Disposal Lalamilo Wind Farm Substation, Waikoloa, Hawaii

Hawaiian Electric Company, Inc (HECO) requests a cost proposal for the demolition, packaging, transportation and disposal of the HECO Electronic Shock Absorber (ESA) trailer, its contents, and the adjacent stairways. The ESA is currently located at the Lalamilo Wind Farm substation, Waikoloa, Hawaii. HECO will not be responsible for any costs incurred during the preparation of the cost proposal.

The cost estimate must include: mobilization and demobilization cost of personnel and equipment, travel, lodging, labor, material, and any subcontracted services (such as transportation and disposal services).

Scope of Work

The project location is the Lalamilo Wind Farm Substation in Waikoloa, Island of Hawaii, Hawaii. As part of the Lalamilo Wind Farm, there is an Electronic Shock Absorber (ESA) trailer which consists of electrical equipment (ultracapacitor modules, inverters and other electrical equipment) housed in a 30-foot trailer. The ESA trailer was damaged by fire beyond repair during the October 2006 earthquake. Photographs of the ESA trailer are shown in Attachment A. Available information regarding the ultracapacitor modules, which may still contain acetonitrile, is presented in Attachment B.

The scope of work shall include:

- Prepare and submit a brief work plan that describes the work to be performed, a list of the equipment that will be used, and safety precautions that will be taken.
- Prepare the ESA trailer and its contents for disposal, recycling and/or incineration in accordance with State and Federal regulations. This can include, but is not limited to:
 - o on-site dismantling and packaging
 - o transportation to an off-site, but on-island, location for dismantling and packaging
 - o draining of the acetonitrile from the ultracapacitor modules, if required
- Transport the acetonitrile and / or acetonitrile containing ultracapacitor modules to the mainland for disposal or incineration
- Demolition, transport and disposal of two adjacent stairways associated with the ESA trailer
- Documentation which demonstrate disposal, recycling, and/or incineration must be provided. This can be in the form of signed return to generator manifest, certificates of disposal, or equivalent.

HECO T-6 ATTACHMENT 5 (L) PAGE 2 OF 39 AUGUST 2007 SUPPLEMENT

Assumptions

The following assumptions may be used when preparing the cost proposal:

- Assume a 2 week duration for review of the brief work plan
- The Contractor may not mobilize prior to receiving written approval of the brief work plan
- Assume that field work will begin in late Summer / Fall and be completed by Dec. 31, 2007
- A 2-hr HELCO safety briefing will be required for all Contractor personnel prior to work at the Lalamilo Wind Farm Substation
- Assume that the ESA trailer will be disconnected from all other electrical equipment at the Lalamilo Wind Farm Substation prior to mobilization
- Assume that all acetonitrile wastes will be transported to a mainland disposal facility and/or incinerated. No hazardous wastes generated from this project may be disposed on Hawaii or Oahu.
- Non-hazardous debris, such as the stairs, may be disposed on Hawaii
- Maximum quantity of acetonitrile in the ESA was 48 gallons. However, the majority of the ultracapacitors either leaked or caught on fire which decreased the amount of acetonitrile in the ESA trailer.
- The project will be executed under a time and material contract with a not-to-exceed limit.

Contractor Qualifications and Requirements

- 1. Contractors or their subcontractors who transport hazardous waste must have an EPA ID number.
- 2. Contractor personnel who will work at the Lalamilo Wind Farm Substation must have a valid picture identification to access the facility.
- 3. All Contractor personnel who will work at Lalamilo Wind Farm Substation must comply with the HECO Contractor Dos and Don'ts list, presented in Attachment C.

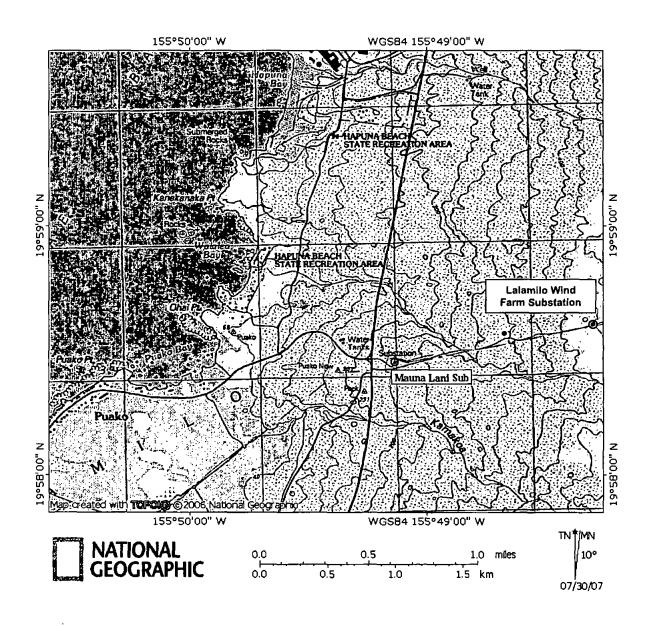
Cost Proposal

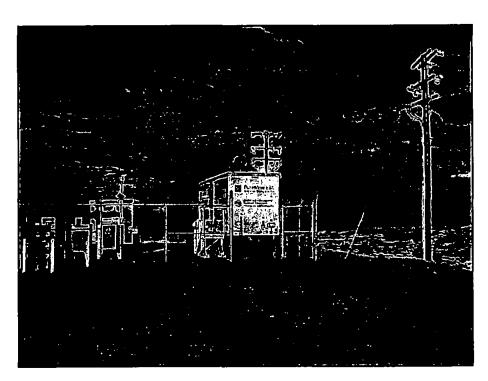
The cost proposal will consist of a bullet point list or short narrative describing the proposed work, a cost estimate and a project schedule (especially the number of days on site at the Lalamilo Wind Farm Substation). Please list all assumptions used in developing the cost proposal. Please submit the cost proposal to David Kaneko via e-mail at David.Kaneko@heco.com or fax at (808) 543-5710. Proposals must be received by August 15, 2007.

Any questions regarding this request for proposal should be directed to David Kaneko at (808) 543-4524 or David.Kaneko@heco.com.

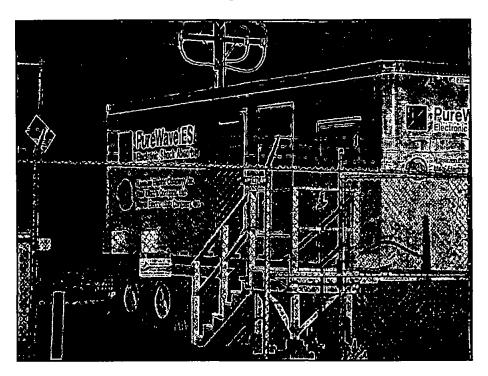
HECO T-6 ATTACHMENT 5 (L) PAGE 3 OF 39 AUGUST 2007 SUPPLEMENT

ATTACHMENT A MAPS AND PHOTOGRAPHS

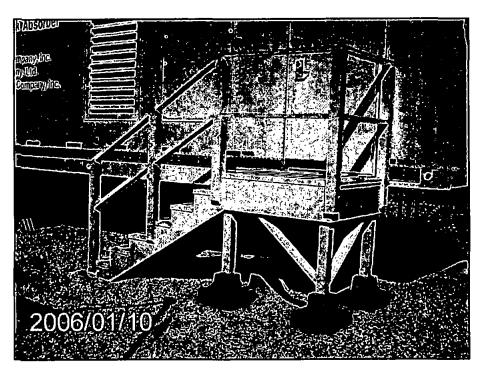




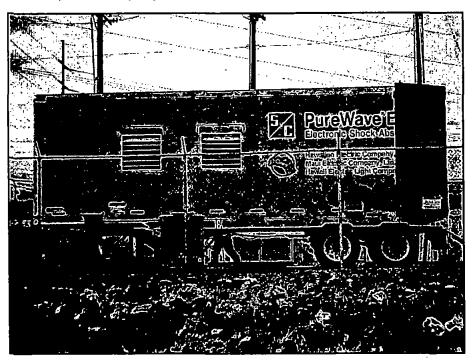
View of ESA trailer and surroundings of Lalamilo Wind Farm Substation.



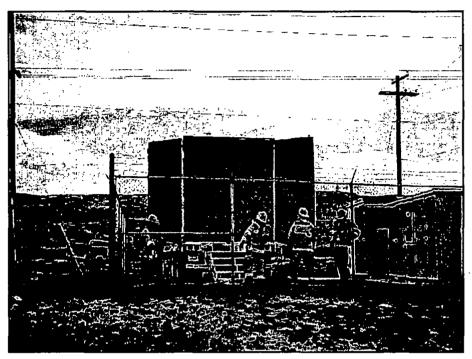
View of scorch marks on vents on trailer. Also note stairway adjacent to trailer.



Close-up of stairway adjacent to ESA trailer.



Opposite side of ESA trailer; note scorch marks on side of trailer.



Back side of ESA trailer; note stairway to enter ESA trailer.



Fire-damaged ultracapacitor cabinets in ESA trailer.

HECO T-6 ATTACHMENT 5 (L) PAGE 8 OF 39 AUGUST 2007 SUPPLEMENT



Close up of stairway at back side of ESA trailer.

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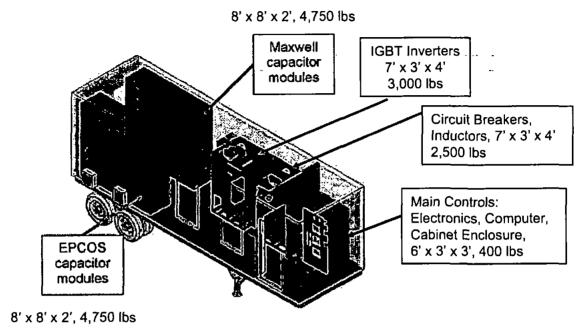
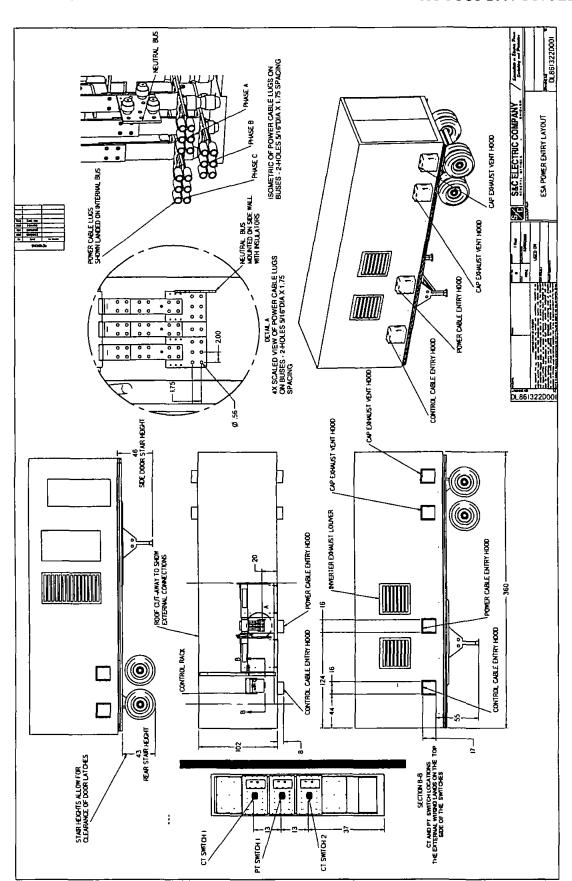


Figure 1: S&C Electric PureWave® ESA

TRAILER and everything in it (total):
30'L X 104"W X 162"H, 25,000 lbs
All quantities above are rough estimates

HECO T-6 ATTACHMENT 5 (L) PAGE 10 OF 39 AUGUST 2007 SUPPLEMENT



HECO T-6 ATTACHMENT 5 (L) PAGE 11 OF 39 AUGUST 2007 SUPPLEMENT

ATTACHMENT B ULTRACAPACITOR MODULE INFORMATION

ATTACHMENT B

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Disposal of equipment

The significant amount of damage that was done to the ESA system has rendered it unusable. Although the fire was contained to the Maxwell capacitor assembly, smoke and heat damage to the remainder of the system damaged it beyond repair.

The inverter and control sections of the unit are standard electronics, steel, copper and aluminum materials and can be disposed of in accordance to local regulations.

The ultracapacitors contain acetonitrile/tetraethylammonium tetrefluoroborate as the electrolyte. Referring to the attached Maxwell document for handling damaged capacitors and discussions with Maxwell personnel, the electrolyte is flammable but not corrosive or toxic. Evaporation of the electrolyte leaves behind a white salt residue which is non corrosive and non toxic. Damaged capacitors should be disposed of by incineration or in accordance with local regulations. The Maxwell capacitors had significant fire damage and most have ruptured and burned. The significant amount of soot from the capacitors is from the internal organic materials (Cellulose – paper). If the capacitors have been destroyed by fire they can be disposed of with the remainder of the trailer components. Any capacitors that have not been ruptured and destroyed should be separately destroyed by incineration or in accordance with local regulations. The EPCOS capacitors contain the same materials and require the same handling. The EPCOS capacitors were not damaged by fire suffering only heat and smoke effects. These capacitors will require disposal by incineration or in accordance with local regulations.

Attached are 3 documents, Maxwell – Customer Guidelines Handling Damaged Capacitors, Maxwell Ultracapacitors MSDS, and the EPCOS MSDS for Acetonitrile.

To complete the cleanup, the capacitors should be removed for separate disposal by a local hazardous material team. Once the capacitors are removed the trailer can be disposed of using normal procedures.



HECO T-6 ATTACHMENT 5 (L) PAGE 13 OF 39 AUGUST 2007 SUPPLEMENT

Customer Guidelines Handling Damaged Capacitor

October 2006

During the life of an application uncontrolled events may cause a compromise to the integrity of the provided packaging of the ultracapacitor. This may be related, but not limited, to crushing, penetration, over voltage or fire. The following document is provided as a general guide for handling of ultracapacitors in which the packaging has become compromised.

The primary constituents of construction for an ultracapacitor in order of weight % include:

Aluminum (packaging)
Carbon (electrode)
Acetonitrile/tetraethylammonium tetrafluoroborate (electrolyte)
Cellulose (paper, separator)

None of the materials are classified as corrosive, toxic, or are considered heavy metals. The electrolyte is classified as a flammable. An MSDS for the electrolyte can be made available upon request.

Scenario: Crushed, penetrated or leaking capacitor

A capacitor which has had the packaging compromised is typically evidenced by the observance of a white residue around the location of compromise. The white residue is the salt left behind from the evaporation of the solvent in the electrolyte. The salt is tetraethylammonium tetrafluoroborate (TEATFB). The salt is non toxic, non corrosive. It is miscible in water. Some local regulations allow for rinsing and disposing in small quantity in the treated wastewater system with sufficient dilution. Please check with local regulations.

If salt residue is present due to a compromise in the package, the capacitor should be treated as a source of ignition since the electrolyte is considered flammable. Almost no free liquid is contained within the capacitor, so an open capacitor may appear to be dry. The solvent may continue to evaporate and the rate of evaporation will be higher at higher temperatures. The density of the vapor is greater than air, so vapors may settle.

A mild odor may be detected in a package severely compromised. The concentration of permissible vapor levels established by OSHA for exposure is higher than the threshold of odor detection. Therefore, the vapor is detectable far in advance of the levels considered as a nuisance or threatening to health, long or short term, exposure levels.

- •A compromised package should be removed to a well ventilated area, away from any ignition source.
- ·Latex or nitrile gloves should be used when handling
- ·Salt residue should not be ingested, wash hands after handling

Disposal of compromised product should be in accordance to local regulations



HECO T-6 ATTACHMENT 5 (L) PAGE 14 OF 39 AUGUST 2007 SUPPLEMENT

Customer Guidelines Handling Damaged Capacitor

Scenario: Over voltage capacitor

A capacitor that has experienced significant over voltage may have compromised package due to the rupture of a mechanical fuse in the packaging. An over voltage capacitor is typically identifiable by a dark brown residue rather than the white residue previously described. The odor is generally stronger and more obvious. Identical precautions should be observed as described in the previous scenario.

- •A compromised package should be removed to a well ventilated area, away from any ignition source.
- ·Latex or nitrile gloves should be used when handling
- •Residue should not be ingested, wash hands after handling

Disposal of compromised product should be in accordance to local regulations

Scenario: Capacitor in fire

A capacitor subjected to fire may be in a variety of conditions depending on the nature of the fire and the amount of exposure. As the majority of the capacitor is comprised of organic materials a significant amount of soot may be observed in the surrounding area of the capacitor. Depending on how completely the capacitor is consumed, no odor or significant odor may be present. Identical precautions should be observed as described in the previous scenarios.

- A compromised package should be removed to a well ventilated area, away from any ignition source.
- ·Latex or nitrile gloves should be used when handling
- ·Residue should not be ingested, wash hands after handling

Disposal of compromised product should be in accordance to local regulations. Cleaning of surrounding area is acceptable with mild detergents. Cleaning materials may be disposed of with normal trash as soot materials are not flammable or toxic.

In all scenarios described if product may not be readily moved to a ventilated area and any residual odor is present, it may be necessary to use a respirator if the odors are irritating. Use of a respirator should only be used by properly trained individuals.

If at any time dizziness or lightheadedness is felt, individual should remove themselves of the area and get fresh air.

Company internal policy should supersede any recommendation made by Maxwell Technologies.

MATERIAL SAFETY DATA SHEET

PARTI

What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED):

CHEMICAL NAME/CLASS:

SYNONYMS:

MODELS:

U.N. NUMBER:

U.N. DANGEROUS GOODS CLASS/SUBSIDIARY RISK:

HAZCHEM CODE (AUSTRALIA):

POISONS SCHEDULE NUMBER (AUSTRALIA):

PRODUCT USE:

SUPPLIER/MANUFACTURER'S NAME:

ADDRESS:

EMERGENCY PHONE:

BUSINESS PHONE: DATE OF PREPARATION: DATE OF REVISION:

Supercapacitor

ULTRACAPACITOR

Capacitor Containing Electrolyte Solution Absorbed in Carbon Double Laver Capacitor: Electrochemical

This document is prepared for all models of Ultracapacitors

manufactured by Maxwell Technologies, Inc.

Class 3 (Flammable)

2WE

None Allocated

Energy Storage Device

MAXWELL Technologies Inc.

9244 Balboa Ave San Diego CA 92123

Domestic 01(800) 424-9300: International + 1 (703) 527-3887

01-(858) 503-3300

May 12, 1998

July 24, 2002

2. COMPOSITION and INFORMATION ON INGREDIENTS

Maxwell's Ultracapacitors are manufactured electronic products that primarily contain non-hazardous substances, such as metal and plastic. Ultracapacitors are comprised of a sealed metal container (steel or aluminum), which encloses layers of activated carbon (saturated with an electrolyte solution), aluminum and plastic. The electrolyte solution contains a quaternary salt (tetraethyl aluminum tetrafluoroborate) dissolved in a solvent (acetonitrile). The assembled layers are inserted into the outer metal container and are saturated with the electrolyte, sealed and stored in an uncharged state. The hazards addressed in this document arise where contents of the sealed containers are in an unsealed state. Therefore, if the contents of ultracapacitors remain within the sealed outer shell, and the ultracapacitors are kept in an uncharged state, persons shall avoid most of the risks described herein for each of the separate hazardous components. Precautions should be taken to avoid ruoturing or over-heating the sealed metal container.

CHEMICAL NAME	CAS#	EINECS#	Proportion	EXPOSURE LIMITS IN AIR					
		1	(w/w%)	ACGIH	ACGIH-TLV		OSHA-PEL		OTHER
	ļ			TWA	STEL	TWA	STEL	IDLH	
	_			ppm	ppm	ppm	ppm	ppm_	ppm
Tetraethyl Ammonium Tetrafluoroborate	429-06-1	207-055-1	5-15%	NE	NE	NE	NE	NE	NE
Acetonitrile	75-05-8	200-835-2	10-20%	20 (skin)	NE	40	60 (Vacated 1998 PEL)	500	NIOSH REL: TWA = 20 DFG MAK: TWA = 20 (skin) PEAK = 5•MAK, 30min., average value DFG MAK Pregnancy Risk Classification: C Carcinogenicity: EPA- CBD, EPA-D, TLV-A4
Activated Carbon	7440-44-0	231-153-3	10-20%	NE	NE	NE	NE	NE _	NE
Other components which form the balance of the capacitor (e.g., metal can, plastic sheet).			Balance	None of the other components contribute significant additional hazards concentrations present in this product. All pertinent hazard information has provided in this document, per the requirements of the Federal Occup Safety and Health Administration Standard (29 CFR 1910.1200), U.S. equivalent Standards; Canadian Workplace Hazardous Materials Identif System Standards (CPR 4); and the applicable Council Directives of the Fur				azard Information has beer the Federal Occupationa R 1910.1200), U.S. State ous Materials Identification	

NE = Not Established

See Section 16 for Definitions

NOTE: All WHMIS, Australian WorkSafe, and European Community required information is included. It is located in appropriate sections based on the ANSI Z400.1-1998 format.

3. HEALTH HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Under normal conditions, ultracapacitors present minimal hazards because all of the components are sealed in a durable metal container. The hazards described below would apply only when the integrity of the container has been compromised and the electrolyte solution is released. If released electrolyte solution contaminates skin, it has the potential to cause mild to moderate irritation, depending on duration of exposure. The electrolyte solution has the potential to ignite due to the presence of Acetronitrile. The electrolyte solution is not reactive. Appropriate precautions should be taken in event of rupture of container or fire involving these ultracapacitors.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: There is no health hazard anticipated to occur during routine use of this product. In the unlikely event that the metal can ruptures and the electrolyte solution is released, there are potential health hazard issues to address which may impact individuals in the immediate vicinity. The most significant routes of such overexposure are inhalation and contact with skin and eyes.

FOR ACETONITRILE

The symptoms of overexposure to the electrolyte solution or solvent, via route of entry, are as follows:

INHALATION: In the unlikely event that the metal can ruptures and the electrolyte solution is released, there may be inhalation hazard which could impact individuals in the immediate vicinity. Breathing mists or aerosols of the electrolyte solution or solvent can lead to irritation of nose, throat, or respiratory system. Symptoms of such exposure could include coughing and sneezing. Though not likely to occur, it may be important to note that due to the presence of acetonitrile (the solvent component of this product), severe inhalation overexposures can lead to weakness, shortness of breath, nausea, vorniting, and other health effects which would require medical

CONTACT WITH SKIN or EYES: In the untikely event that the metal can ruptures and the electrolyte solution is released, there may be contact hazards which could impact individuals in the immediate vicinity. Contact with the electrolyte solution or solvent can lead to mild to moderate eye irritation. Direct eye contact with the liquid can cause stinging, tearing, and redness. Skin contact with the electrolyte solution or solvent may be slightly to moderately irritating, especially after protonged exposure. Repeated skin contact with the electrolyte solution (which is a salt), may lead to irritation, such as dermatitis. Symptoms are generally alleviated when exposure ends. SKIN ABSORPTION: Skin absorption is a potential route of overexposure to acetonitrile, the solvent component of this product. In the unlikely event that the metal can ruptures and the solvent is released, contaminating individuals in the immediate vicinity, symptoms of such exposure may include those described for "inhalation" or "Contact With Skin and Eyes".

HEALTH HAZARD (BLUE) 2

FLAMMABILITY HAZARD (RED) 3

PHYSICAL HAZARD (YELLOW) 0

PROTECTIVE EQUIPMENT B

For Routine Industrial Use and Handling Applications
See Section 16 for Definition of Ratings

SEE SECTION 8

8

INGESTION: Though not anticipated to be a route of occupational exposure, ingestion of the electrolyte solution or solvent can irritate the tissues of the mouth, esophagus, and other tissues of the digestive system. Symptoms of such exposure could include coughing and sneezing. Though not likely to occur, it may be important to note that due to the presence of acetonitrile (the solvent component of this product), severe ingestion overexposures can lead to weakness, shortness of breath, nausea, vomiting, and other health effects which would require immediate medical attention.

INJECTION: This is not anticipated to be a route of occupational exposure.

OTHER HEALTH EFFECTS: Risk of Shock/Spark: Ultracapacitors are capable of storing an electric charge, although they are discharged when stored. (e.g. large ultracapacitors are short-circuited during storage). When in operation ultracapacitors are likely to contain a charge. Individual cells are rated at 2.5V maximum when operational. The voltage of any device is a function of the number of discrete cells connected in series; cells connected in series may have higher voltage, which will be labeled on the device. Precautions should be taken to avoid electric shock and unintended discharge where ultracapacitors are in a charged state. In an extreme situation, if shock occurs, there is a risk that the heart and/or breathing can stop.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.

ACUTE: Under normal circumstances, this product is not anticipated to cause any significant health hazards. In the unlikely event that the metal can ruptures and the electrolyte solution is released, there may be health hazards which could impact individuals in the immediate vicinity. The most likely symptom of acute overexposure would be slight to moderate irritation of contaminated skin, or eye irritation after contact with liquid or vapors of the electrolyte solution or solvent. Though not likely to occur, it may be important to note that due to the presence of acetonitrile (the solvent component of this product), severe inhalation, skin contact, or ingestion overexposures can lead to weakness, shortness of breath, nausea, vomiting, and other health effects which would require immediate medical attention. During use, these devices may contain an electric charge, which under certain circumstances could result in discharge of an electric shock and possible cessation of the heart and respiration.

3. HEALTH HAZARD IDENTIFICATION (Continued)

CHRONIC: Repeated skin contact with the electrolyte solution (which is a salt), may lead to irritation. TARGET ORGANS: ACUTE: Skin, eyes (contact with the electrolyte solution or solvent only). CHRONIC: Skin

PART II What should I do if a hazardous situation occurs?

4. FIRST-AID MEASURES

Contaminated individuals must seek medical attention if any adverse effect occurs. Take a copy of the MSDS to physician or health professional with the contaminated individual. If necessary, physicians should refer to Section 11 (Toxicology Information) in the event there is a severe inhalation, skin contact, or ingestion exposure to the solvent component (acetonitrile).

Persons using this product should consult a physician or other medical professional if an accident involving this product results in injury. Specific first-aid measures, applicable to contamination with the electrolyte solution or the solvent, are as follows:

SKIN EXPOSURE: If exposure to the electrolyte solution or the solvent occurs, begin decontamination with copious amounts of running water. Remove exposed or contaminated clothing, taking care not to contaminate eyes. If irritation to the skin occurs after repeated contact with the electrolyte solution (which contains a salt), eliminate exposure. If condition persists, consult a physician.

EYE EXPOSURE: If exposure to the electrolyte solution or the solvent occurs, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have the contaminated individual "roll" eyes. The recommended minimum

INHALATION: If mists of the electrolyte solution or the solvent are inhaled, remove contaminated individual to fresh air. INGESTION: If the electrolyte solution or the solvent are swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink egg whites or large quantities of water. Never induce vomiting or give a diluent (i.e. water) to someone who is unconscious, having convulsions, or unable to swallow.

ELECTRIC SHOCK: If electric shock from the devices has resulted in cessation of breathing, immediately begin mouth-tomouth resuscitation. If the heart has stopped, a qualified person should begin CPR. If no person trained in CPR is available, obtain immediate medical advice on how to perform CPR. Immediate medical attention must be sought. MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: No medical conditions are known to be aggravated by this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms. If exposure to the acetonitrile component of this product occurs, it may be important to note that this substances decomposes to form cyanide in the body. In the unlikely event that there is a severe inhalation, skin contact, or ingestion exposure to the solvent, and there is evidence of cyanide poisoning, administer amyl nitrate inhalations. If victim does not respond, inject, intravenously, 0.3 grams sodium nitrite (10 mL of a 3% solution at a rate of 2.5-5.0 mL/minute), followed at once by 12.5 grams of sodium thiosulfate intravenously (50 mL of a 25% solution injected at about the same rate as the sodium nitrite solution). The same needle and vein can be used for both injections. Watch victim continuously for 24-48 hours. If symptoms recur or persist, repeat the sodium nitrite and sodium thiosulfate therapy at one-half the original dose.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable for product. For Acetonitrile: 5.6°C (42°F)

AUTOIGNITION TEMPERATURE: Not applicable for product. For Acetonitrile: 524°C

FLAMMABLE_LIMITS (in air by volume, %): Not applicable for product.

For Acetonitrile: For Acetonitrile:

Lower (LEL): 3.0 to 4.4%

Upper (UEL): 16.0%

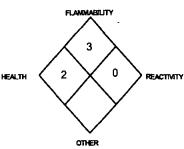
FIRE EXTINGUISHING MATERIALS:

Water Spray: YES Foam: YES

Carbon Dioxide: YES Dry Chemical: YES

Other: Any "ABC" Class

Halon: YES UNUSUAL FIRE AND EXPLOSION HAZARDS: These devices are not flammable under normal operational and non-operational conditions. However, if the ultracapacitors are punctured or exposed to high temperatures as may be encountered in a fire situation, the electrolyte contained within the device may The acetonitrile solvent used in the electrolyte is flammable. If electrolyte is released, vapors from the acetonitrile may spread long distances to an ignition source and flashback. Due to the relatively small amount of acetonitrile contained in ultracapacitors and the saturated condition of the activated carbon, ultracapacitors contain little or no free-standing liquid acetonitrile and therefore the devices are not anticipated to pose a significant FOR ACETONITRILE NFPA RATING



See Section 16 for **Definition of Ratings**

flammability hazard under normal conditions of use, shipment or storage. (continued on following page)

5. FIRE-FIGHTING MEASURES (Continued)

UNUSUAL FIRE AND EXPLOSION HAZARDS: Sealed devices involved in a fire may rupture explosively if sufficiently heated for a long period of time. If involved in a fire, the electrolyte solution will decompose to produce toxic gases (e.g., carbon monoxide, hydrogen cyanide, nitrogen oxides, fluoride and boron compounds).

Explosion Sensitivity to Mechanical Impact: Not applicable.

Explosion Sensitivity to Static Discharge: Not applicable for the product. If the can is ruptured, the liquid inside may be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. In the event that fire-response equipment becomes contaminated with the electrolyte solution or the solvent leaking from a ruptured capacitor, rinse contaminated equipment with soapy water before returning such equipment to service.

6. ACCIDENTAL RELEASE MEASURES

RELEASE RESPONSE: Due to the nature of this product, no special accidental release measures are normally required. Uncontrolled releases involving other materials released near this product should be responded to by appropriately trained personnel using pre-planned procedures.

In the event of a release of the electrolyte solution or solvent, minimum Personal Protective Equipment should be rubber gloves, splash goggles, and appropriate body protection. Remove all sources of ignition before clean-up. Absorb spilled liquid with polypads or other suitable absorbent materials. Decontaminate the area thoroughly. Place all spill residue in a suitable container and seal. Dispose of in accordance with applicable U.S. Federal, State, or local procedures, appropriate Canadian standards, or the applicable standards of Australia or EC Member Sates (see Section 13, Disposal Considerations).

PART III How can I prevent hazardous situations from occurring?

7. HANDLING and STORAGE

WORK, STORAGE AND HANDLING PRACTICES: Avoid breathing the mists or sprays which may be generated if the metal can is ruptured and the electrolyte solution or solvent are released. Additionally, avoid skin or eye contact with these substances. Store this product in a cool, dry location, away from sources of intense heat. Store away from incompatible materials (see Section 10, Stability and Reactivity).

Ultracapacitors are capable of storing an electric charge, although they are transported without a stored charge (e.g. large ultracapacitors are short-circuited during storage). When in operation ultracapacitors are likely to contain a charge. Individual cells are rated at 2.5V maximum when operational. The voltage of any device is a function of the number of discrete cells connected in series; cells connected in series may have higher voltage, which will be labeled on the device. Precautions should be taken to avoid electric shock and unintended discharge where ultracapacitors are in a charged state. All ultracapacitors must be completely discharged (with an appropriate shunt for larger cells) for shipment.

Inspect all incoming devices before storage to ensure containers are properly labeled and not damaged. Refer to NFPA 30, Flammable and Combustible Liquids Code, for additional information on storage. Never perform any welding, cutting, soldering, drilling, or other hot work on these devices.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation and engineering controls are required for use of this product.

INTERNATIONAL OCCUPATIONAL EXPOSURE LIMITS: In addition to the exposure limit values cited in Section 2 (Composition and Information on Ingredients), other exposure limits have been established by various countries for the components of this product, as follows (no listing for a component indicates no values are available): The information is most pertinent under circumstances in which the sealed metal can is ruptured.

ACETONITRILE:

ARAB Republic of Egypt: TWA = 40 ppm (70 mg/m3), Skin, JAN 1993 Australia :TWA = 40 ppm (70 mg/m³), STEL = 60 ppm , Skin, JAN 1993 Austria: MAK = 40 ppm (70 mg/m³), JAN1999 Belgium: TWA = 40 ppm (67 mg/m³), STEL = 60 ppm (101 mg/m³), Skin,

Denmark: TWA = 40 ppm (70 mg/m³), JAN 1999

Finland: TWA = 40 ppm (70 mg/m3), STEL = 60 ppm (105 mg/m3), JAN

France: VME = 40 ppm (70 mg/m3), Skin, JAN 1999

Germany: MAK = 40 ppm (70 mg/m³), JAN 1999 Hungary: TWA = 50 mg/m³, STEL = 100 mg/m³, Skin, JAN 1993

The Netherlands: MAC-TGG= 40 ppm (70 mg/m³), JAN 1999 Norway: TWA = 30 ppm (50 mg/m³), JAN 1999 The Philippines: TWA = 40 ppm (70 mg/m³), JAN 1993 Poland: TWA = 70 mg/m³, STEL = 140 mg/m³, JAN 1999 Russla STEL = 10 mg/m³, JAN 1993

ACETONITRILE (continued):

Sweden: TWA = 30 ppm (50 mg/m3), STEL = 50 ppm (100 mg/m3), JAN

Switzerland: MAK-W = 500 ppm (1200 mg/m3), STEL = 1000 ppm (2400 mg/m³), JAN 1999 Turkey: TWA = 40 ppm (70 mg/m³), JAN 1993

United Kingdom: TWA = 40 ppm (68 mg/m3), STEL = 60 ppm (102 mg/m³), SEP 2000

In Argentina, Bulgaria, Colombia, Jordan, Korea, New Zealand, Singapore, Vietnam check ACGIH TLV

ACTIVATED CARBON:

AUStria: MAK = 6 mg/m³ (resp. dust), JAN 1999
Germany: MAK 6 mg/m³ (resp. dust), JAN 1999
Sweden: TWA = 3 mg/m³ (dust), JAN 1999
Switzerland: MAK-W 2.5 mg/m³ (resp. dust), JAN 1999
Switzerland: MAK-W 5 mg/m³ (inhalable dust), JAN 1999
United Kingdom: LTEL 5 mg/m³ (resp. dust), JAN 1999

In Argentina, Bulgaria, Colombia, Jordan, Korea, New Zealand, Singapore, Vietnam check ACGIH TLV

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

RESPIRATORY PROTECTION: None needed under normal circumstances of use. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, and EC member states, or the Australian Standard 1716-Respiratory Protective Devices and Australian Standard 1715-Selection, Use, and Maintenance of Respiratory Protective Devices. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under U.S. Federal OSHA's Respiratory Protection Standard (1910.134-1998) or the regulations of various U.S. States, Canada, Australia, or EC Member States.

EYE PROTECTION: No special eye protection is required for use of this product. Wear safety glasses or goggles if situations involving this product involve contact with the electrolyte solution or the solvent. If necessary, refer to U.S. OSHA 29 CFR 1910.133, the European Standard EN166, or the Australian Standard 1337-Eye Protection for Industrial Applications and Australian Standard 1336-Recommended Practices for Eye Protection in the Industrial Environment for further information.

HAND PROTECTION: No special hand protection is required for use of this product. If necessary, wear rubber if situations involving this product involve contact with the electrolyte solution or the solvent. If necessary, refer to U.S. OSHA 29 CFR 1910.138, Australian Standard 2161-Industrial Safety Gloves and Mittens and appropriate Standards of the EC and Canada for further information.

BODY PROTECTION: No special body protection is required for use of this product. If necessary, wear lab-coat, coveralls, or rubber apron if situations involving this product involve contact with the electrolyte solution or the solvent. If necessary, refer to Australian Standard 3765-Clothing for Protection Against Hazardous Chemicals for further information. If a hazard of iniury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

pH: Not applicable. FORM: Liquid.

EVAPORATION RATE (n-BuAc = 1): 5.79

ODOR: Sweetish, like lacquer. Lachrymator.

BOILING POINT: 81.6°C (179°F)

FLASH POINT: 5.6°C (42°F)

MELTING/FREEZING POINT: -41 to -45.7°C (-41.8 to -50.3°F)

The following information is for the acetonitrile component:

RELATIVE VAPOR DENSITY (air = 1): 1.4

SPECIFIC GRAVITY (water = 1): 0.787

SOLUBILITY IN WATER: Soluble

VAPOR PRESSURE @ 20°C: 77 mmHg (9.7 kPa)

ODOR THRESHOLD: 42 ppm (detection)

COLOR: Colorless liquid.

VISCOSITY: Not available.

COEFFICIENT OF OILWATER DISTRIBUTION (PARTITION COEFFICIENT): Log P(oct) = -0.34

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of acetonitrile may act as a distinguishing characteristic.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: If involved in a fire, this product may rupture, and release components which will decompose to produce toxic gases (e.g., carbon monoxide, acetic acid, ammonia, hydrogen cyanide, nitrogen oxides, fluoride and boron compounds). In contact with water the acetonitrile component may release toxic and flammable vapors. MATERIALS WITH WHICH PRODUCT IS INCOMPATIBLE: The acetonitrile component is incompatible with strong acids, strong bases, reducing agents, water.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid exposure or contact with extremely high temperatures or incompatible chemicals.

PART IV Is there any other useful information about this material?

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicity data are available for the components of the product, listed in Section 2 (Composition and Information on Ingredients):

ACETONITRILE:

Standard Draize Test (Eye-Rabbit) 100 µL/24 hours: Moderate\

Open Irritation Test (Skin-Rabbit) 500 mg: Mild TDLo (Oral-Child) 800 mg/kg: Behavloral: hallucinations, distorted, convulsions or effect on selzure threshold; Gastrointestinal; nausea or vomiting

TDLo (Oral-Man) 571 mg/kg: Behavioral: convulsions or effect on seizure threshold; Gastrointestinal; nausea or vomiting; Nutritional and Gross Metabolic: metabolic acidosis

ACETONITRILE (continued):

TDLo (Oral-Man) 64 mg/kg: Behavioral: excitement

TDLo (Oral-Woman) 500 mg/kg: Behavioral: coma; Cardiac: pulse rate increase, without fall in BP; Lungs, Thorax, or Respiration: respiratory depression

TDLo (Oral-Hamster) 300 mg/kg; female 8 day(s) after conception; Reproductive: Specific Developmental Abnormalities; musculoskeletal system

ACETONITRILE (continued):

LD_{so} (Skin-Rabbit) 1250 µL/kg LD₅₀ (Intraperitoneal-Rat) 850 mg/kg

LD_{so} (Intraperitoneal-Mouse) 175 mg/kg: Sense Organs and Special Senses (Eye): comeal damage; Behavioral: ataxia Lungs, Thorax, or Respiration: dyspnea

TDLo (Oral-Hamster) 400 mg/kg: female 8 day(s) after conception: Reproductive: Fertility: postimplantation mortality (e.g. dead and/or resorbed implants per total number of implants)

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued)

ACETONITRILE (continued): LD_{sp} (Oral-Rat) 2460 mg/kg

LD₅₀ (Oral-Mouse) 269 mg/kg

LD₅₀ (Oral-Cat) 200 mg/kg

LD₅₀ (Oral-Rabbit) 50 mg/kg

LD₅₀ (Oral-Guinea Pig) 177 mg/kg

LD₅₀ (Oral-Memmal-Species Unspecified) 1670

LD₅₀ (Subcutaneous-Rat) 3500 mg/kg

LD₅₀ (Subcutaneous-Mouse) 4480 mg/kg

LD₅₀ (Intravenous-Rat) 1680 mg/kg

LD₅₀ (Intravenous-Mouse) 612 mg/kg LD₅₀ (Parenteral-Rat) 1100 mg/kg

LCLo (Inhalation-Dog) 16000 ppm/4 hours LC₅₀ (Inhalation-Rat) 7551 ppm/8 hours: Behavloral: altered sleep time (Including change in righting reflex), convulsions or effect on seizure threshold Blood; hemorrhage

LC₅₀ (Inhalation-Mouse) 2693 ppm/1 hour. Liver: other changes

LC₅₀ (Inhalation-Cat) 18 gm/m³

(Inhalation-Rabbit) 2828 ppm/4 hours: Behavioral: altered sleep time (including change in righting reflex), convulsions or effect on seizure threshold; Blood; hemorrhage

LC₂₀ (Inhalation-Guinea Pig) 5655 ppm/4 hours: Behavioral: altered sleep time (including change in righting reflex), convulsions or effect on seizure threshold; Blood: hemorrhage

LDLo (Subcutaneous-Rabbit) 105 mg/kg

(Subcutaneous-Frog) 9100 mg/kg: Peripheral Nerve and Sensation: paralysis with or without sensory spastic change Lungs, Thorax, or Respiration: dyspnea

TCLo (Inhalation-Human) 160 ppm/4 hours: Lungs, Thorax, or Respiration: other changes
TCLo (Inhalation-Rat) 400 ppm/6 hours /2 years-

Intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Liver:

ACETONITRILE (continued):

TCLo (Inhalation-Rat) 655 ppm/7 hours /90 daysintermittent: Lungs, Thorax, or Respiration: chronic pulmonary edema; Liver: other changes; Kidney, Ureter, Bladder, changes in tubules (including acute renal failure; acute tubular necrosis)

TCLo (Inhalation-Rat) 800 ppm/6 hours /13 weeks-Intermittent; Behavioral; somnolence depressed activity), Reproductive: Tumorigenic effects: reproductive system tumors

TCLo (Inhalation-Rat) 1800 ppm/6 hours: female 6-20 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

TCLo (Inhalation-Mouse) 800 ppm/6 hours /13 weeks-intermittent: Behavloral: somnolence (general depressed activity); Lungs, Thorax, or Respiration: chronic pulmonary edema; Reproductive: Tumorigenic effects: reproductive system tumors

TCLo (Inhalation-Dog) 350 ppm/7 hours /91 Nutritional and days-intermittent: Metabolic: weight loss or decreased weight

TCLo (Inhalation-Monkey) 350 ppm/7 hours /91 days: Brain and Coverings: changes in circulation (hemorrhage, thrombosis, etc.); Lungs, Thorax, or Respiration: emphysema; Blood: changes in erythrocyte (RBC) count

TCLo (Inhalation-Hamster) 8000 ppm/1 hour. female 8 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), Specific Developmental Abnormalities: musculoskeletal system

ACETONITRILE (continued):

TCLo (Inhalation-Hamster) 5000 ppm/1 hour. day(s) female 8 after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants), Specific Developmental Abnormalities: Central Nervous

Sex chromosome loss (Inhalation-Drosophila melanogaster) 131 ppm

Sex chromosome loss and nondisjunction (Yeast-Saccharomyces cerevisiae) 47600 ppm Sister chromatid exchange (Hamster-Ovary) 5 gm/L

ACTIVATED CARBON: LD (Oral-Rat) > 5 gm/kg

LD (Oral-Mouse) > 5 gm/kg

LD (Oral-Dog) > 5 gm/kg

LD (Intraperitoneal-Rat) > 5 gm/kg

LD (Intraperitoneal-Rat) > 5 gm/kg

LD (Intraperitoncal-Dog) > 5 gm/kg

LD (Intraperitoneal-Mouse) > 5 gm/kg

LD (Subcutaneous-Rat) > 5 gm/kg LD (Subcutancous-Mouse) > 5 gm/kg

LD (Subcutaneous-Dog) > 5 gm/kg

LDs (Intravenous-Mouse) 440 mg/kg

TDLo (Subcutaneous-Rat) 167 mg/kg: female 8 day(s) after conception: Reproductive:

Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

TETRAETHYL AMMONIUM TETRAFLUORO-**BORATE:**

LD₅₀ (Oral-Rat) 2000-5000 mg/kg LD₅₀ (Skin-Rat) > 5000 mg/kg

SUSPECTED CANCER AGENT: Components of this product are listed by agencies tracking carcinogenic potential, as follows:

ACETONITRILE: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); EPA-CBD (Cannot Be Determined); EPA-D (Not Classifiable as to Human

The remaining components of this product are not found on the following lists: U.S. FEDERAL OSHA Z LIST, NTP, IARC. and CAL/OSHA and therefore are neither considered to be nor suspected to be cancer-causing agents by these agencies. IRRITANCY OF PRODUCT: This product is not irritating under normal circumstances of use or handling. There is the potential for mild to moderate initiation of the tissues contaminated with electrolyte solution or the solvent.

SENSITIZATION TO THE PRODUCT: This product contains no known sensitizer after prolonged or repeated contact. REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: This product is not reported to produce mutagenic effects in humans. Mutation data are reported for acetonitrile (the solvent component of this product); such data were obtained during clinical studies of test animals exposed to relative high concentrations of this substance. This is not anticipated to be a significant hazard with unruptured capacitors.

Embryotoxicity: This product is not reported to produce embryotoxic effects in humans.

Teratogenicity: This product is not reported to cause teratogenic effects in humans.

Reproductive Toxicity: This product is not reported to cause reproductive effects in humans. Reproductive toxicity data are reported for the acetonitrile and activated carbon; such data were obtained during clinical studies of test animals exposed to relative high concentrations of this substance. This is not anticipated to be a significant hazard with unruptured capacitors.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

ACGIH BIOLOGICAL EXPOSURE INDICES: Currently, there are no ACGIH Biological Exposure Indices (BEIs) associated with the components of this product.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: This product is relatively stable in the environment. If the capacitors are left in a warm, moist environment for prolonged periods of time, the metal will rust, creating the potential for rupture of the metal can and a release of the components of this product. The following environmental information is applicable to the components of this

ACETONITRILE:

Terrestrial Fale: Based on a classification scheme, an estimated Koc value of 16, determined from a log Kow of -0.34 and a regression-derived equation, indicates that acetonitrile is expected to have very high mobility in soil. Volatilization of acetonitrile from moist soil surfaces is expected to be an important fate process given a Henry's Law constant of 3.45X10-5 atm-cu m/mole. The potential for volatilization of acetonitrite from dry soil surfaces may exist based upon a vapor pressure of 88.8 mm Hg. In water, biodegradation studies of acetonitrile with mixed cultures of microorganisms from activated sludge and sewage show that degradation proceeds sluggishly without acclimatization of microorganisms, particularly at high concentrations. Acclimated mixed microbial cultures isolated by an enrichment culture technique degraded 58% acetonlirile in 5

Aquatic Fate: Based on a classification scheme, an estimated Koc value of 16, determined from a log Kow of -0.34 and a regression-derived equation, Indicates that acetonitrile is not expected to adsorb to suspended solids and sediment. Volatilization from water surfaces is expected based upon a Henry's Law constant of 3.45X10-5 atm-cu m/mole. Using this Henry's Law constant and an estimation method, volatilization half-lives for a model river and model take are 12 hours and 7 days, respectively. According to a classification scheme, an estimated BCF of 3, from its log Kow and a regression-derived equation, suggests the potential for bioconcentration in aquatic organisms is low. The biodegradation studies of acetonitrile with mixed cultures of microorganisms from activated sludge and sewage show that degradation proceeds sluggishly without acclimatization of microorganisms, particularly at high concentration. Acclimated mixed microbial cultures isolated by an enrichment culture technique degraded 58% acetonitrile in 5 days. The biodegradability of acetonitrile was also observed with river water; the 12 day ThOD (theoretical oxygen demand) with river water was 40%

Atmospheric Fate: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere, acetonitrile, which has a vapor pressure of 88.8 mm Hg at 25°C, is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase acetonitrile is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 621 days, calculated from its rate constant of 2.63X10-14 cu cm/molecule-sec at 25°C. Acetonitrile does not undergo direct photolysis in the vapor phase,] Bioconcentration: An estimated BCF of 3 was calculated for acetonitrile, using a log Kow of -0.34 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: This product is not anticipated to cause adverse effects on terrestrial plants and animals. In the event that the metal can is ruptured and the electrolyte solution and the solvent are released into the environment, there may me a local impact on the environment.

EFFECT OF CHEMICAL ON AQUATIC LIFE: This product is not anticipated to cause adverse effects on aquatic plants and animals. In the event that the metal can is ruptured and the electrolyte solution and the solvent are released into the environment, there may be a local impact on the aquatic environment. The following aquatic toxicity data are available for this product's components:

ACETONITRILE:

TLm (Pimephales promeias fathead minnows) 96 hours = 1,020 mg/L (hard water, conditions of bioassay not specified)

_C₅₀ (Pimephales promelas fathead minnows) 96 hours = 680 mg/L LC50 (Pimephales promelas fathead minnows) 96 hours = 1010 mg/L in hard water

LC50 (Pimephalas prometas fathead minnows) 96 hours = 1000 mg/L in

LC₅₀ (Pimephales promeles fathead minnows) 96 hours = 1600-1690 mg/L (flow-through bloassay, lake water, at 26.1°C, pH 7.4, 43 mg/L

LC₅₀ (*Pimephales promelas* fathead minnows) 16 hours = 1,640 mg/L (confidence limit 1,600-1,690 mg/L, flow-through bloassay with measured concentrations, 26.1°C, dissolved oxygen 6.1 mg/L, hardness 43.0 mg/L calcium carbonate, alkalinity 46.0 mg/L calcium carbonate, and pH 7.4)

ACETONITRILE (continued):

LC₅₀ (Lepomis macrochirus bluegill) 1850 mg/L in soft water

LC₅₀ (Lebistes reticulatus guppies) 96 hours = 1650 mg/L in soft water)

LC50 (Oryzias latipes, juvenile) 24-48 hours = 1000 mg/L (static assay, distilled water at 25°C)

EC₀ (Pseudomonas pudita Bacterla) 16 hours = 680 mg/L

EC₀ (Microcystis Aeruginosa Algae) 8 days = 520 mg/L

ECo (Scenedesmus Quadricausa Algae) 7 days = 7300 mg/L ECo (Entosiphon sulcatum Protozoa) 72 hours = 1810 mg/L

EC₀ (Urenos parduvzi, Chatton-Lwoff Protozoa) = 5,825 mg/L

Confidence limit 1,600-1,690 mg/L, flow-through bloassay with measured concentrations, 26.1°C, dissolved oxygen 6.1 mg/L, hardness 43.0 mg/L, calcium carbonate, alkalinity 46.0 mg/L calcium carbonate, and pH 7.4 Effect loss of equilibrium)

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: This product contains acetonitrile (which is regulated as a Characteristic/Ignitable Liquid under the US RCRA Standards). Subsequently, Maxwell Technologies, Inc. recommends that companies contact the local hazardous waste handling authority for guidance on the proper disposal procedures for the product.

U.S. EPA WASTE NUMBER: Wastes of this product should be tested to see if they meet the criteria of D001 Waste Characteristic/Flammability and U003, due to the presence of acetonitrile.

14. TRANSPORTATION INFORMATION

THIS PRODUCT IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF

TRANSPORTATION.

PROPER SHIPPING NAME:

Acetonitrile solution

HAZARD CLASS NUMBER and DESCRIPTION: Class 3 (Flammable) UN IDENTIFICATION NUMBER:

UN 1648

PACKING GROUP:

DOT LABEL(S) REQUIRED:

Class 3 (Flammable) (continued on following page)

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14. TRANSPORTATION INFORMATION (Continued)

U.S. DEPARTMENT OF TRANSPORTATION INFORMATION (continued)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER, 2000: 131

MARINE POLLUTANT: No component of this product is designated as a Marine Pollutant, per Appendix B to 49 CFR 172,101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is considered as Dangerous Goods, per regulations of Transport Canada. Refer to above U.S. DOT regulations for shipments to Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA): This product is considered as Dangerous Goods, per

regulations of IATA. Shipping information is as follows:

PROPER SHIPPING NAME: Acetonitrile solution HAZARD CLASS NUMBER and DESCRIPTION: Class 3 (Flammable)

UN IDENTIFICATION NUMBER: UN 1648

PACKING GROUP

HAZARD LABEL(S) REQUIRED: Class 3 (Flammable)

ERG CODE:

INTERNATIONAL MARITIME ORGANIZATION (IMO): This product is considered as Dangerous Goods, per regulations of

IMO. Shipping information is as follows:

PROPER SHIPPING NAME Acetonitrile solution

HAZARD CLASS NUMBER and DESCRIPTION: Class 3.2 (Flammable Liquid)

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UN IDENTIFICATION NUMBER: UN 1648 11

PACKING GROUP:

HAZARD LABEL(S) REQUIRED: Class 3 (Flammable)

STOWAGE and SEGREGATION: None

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD

(ADR): This material is considered by the United Nations Economic Commission for Europe to be dangerous goods.

Shipping information is as follows:

CLASS and ITEM NUMBER:

NAME OF SUBSTANCE: Acetonitrile solution

SUBSTANCE IDENTIFICATION No. (Lower Part): 1648 HAZARD IDENTIFICATION (Upper Part): 33 3

AUSTRALIAN FEDERAL OFFICE OF ROAD SAFETY CODE FOR THE TRANSPORTATION OF DANGEROUS GOODS

3 (b)

BY ROAD OR RAIL: This product is considered as Dangerous Goods, per regulations of the Australian Federal Office of

Road Safety. Shipping information is a follows:

UN IDENTIFICATION NUMBER: UN 1648

PROPER SHIPPING NAME: Acetonitrile solution HAZARD CLASS NUMBER and DESCRIPTION: Class 3 (Flammable)

PACKING GROUP: 11 HAZCHEM CODE: 2WE SPECIAL PROVISIONS: None PACKAGING METHOD: 3.8.3

15. REGULATORY INFORMATION

UNITED STATES INFORMATION FOR PRODUCT:

U.S. SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, and are listed as follows:

CHEMICAL NAME	SARA 302	SARA 304	SARA 313
	(40 CFR 355, Appendix A)	(40 CFR Table 302.4)	(40 CFR 372.65)
Acetonitrile	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the components of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 tb (4,540 kg) may apply, per 40 CFR 370.20.

15. REGULATORY INFORMATION (Continued)

UNITED STATES INFORMATION FOR PRODUCT (continued):

U.S. CERCLA REPORTABLE QUANTITY (RQ): Acetonitrile = 5000 lb (2270 kg)

U.S. TSCA INVENTORY STATUS: This is an article and is not subject to the requirements of TSCA requirements.

OTHER U.S. FEDERAL REGULATIONS: This product meets the definition of an "Article" under the U.S. Federal OSHA Hazard Communication Standard (29 CFR 1910.1200). For further information, the definition of "Article" is provided below. Article means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Acetonitrile is listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. Acetonitrile is included on this list. Acetonitrile is designated as a toxic pollutant, pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. U.S. STATE REGULATORY INFORMATION: Components of this product are covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Acetonitrile.

California - Permissible Exposure Limits for Chemical Contaminants: Acetonitrile. Florida - Substance List: Acetonitrile. Illinois - Toxic Substance List: Acetonitrile. Kansas - Section 302/313 List: Acetonitrile.

Massachusetts - Substance List: Acetonitrile.

Michigan - Critical Materials Register: No. Minnesota - List of Hazardous Substances: Acetonitrile.

Missouri - Employer Information/Toxic Substance List: Acetonitrile.

New Jersey - Right to Know Hazardous Substance List: Acetonitrile, Activated Carbon.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Acetonitrile. Pennsylvania - Hazardous Substance List: Acetonitrile.

Rhode Island - Hazardous Substance List: Acetonitrile.

Texas - Hazardous Substance List Acetonitrile.

West Virginia - Hazardous Substance List: Acetonitrile.

Wisconsin - Toxic and Hazardous Substances: Acetonitrile.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this product is on the California Proposition 65 lists.

ANSI LABELING (Precautionary Statements): FOR ACETONITRILE: DANGERI EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. CAUSES SKIN AND EYE IRRITATION. HARMFUL IF INHALED. CAN BE ABSORBED VIA INTACT SKIN. Keep away from heat, sparks and flame. Avoid breathing vapor or mists. Avoid contact with skin or clothing. Use only with adequate ventilation. Keep container closed. Wash thoroughly after handling. Wear gloves and goggles. FIRST-AID: In case of contact, immediately flush skin or eyes for at least 15 minutes with large amounts of water. If inhaled, move to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If ingested, do not induce vomiting. Get medical attention immediately. IN CASE OF FIRE: Use fog, foam, dry chemical or carbon dioxide. Liquid will float and may re-ignite on the surface of water. IN CASE OF SPILL: Absorb spill with inert material and place in suitable container. Refer to Material Safety Data Sheet for additional information on this product

CANADIAN INFORMATION FOR PRODUCT:

CANADIAN DSL/NDSL INVENTORY: The components of this product are on the DSL Inventory.

OTHER CANADIAN REGULATIONS: WHMIS INGREDIENT DISCLOSURE LIST: Included for disclosure at 0.1% or greater

<u>CANADIAN ENVIRONMENTAL PROTECTION AGENCY (CEPA) PRIORITIES SUBSTANCES LISTS</u>: No component of this product is on the Priorities Substances Lists.

CANADIAN WHMIS SYMBOLS: For Acetonitrile:

Class B2: Flammable and Combustible Material: Flammable liquid

Class D1B: Poisonous and Infectious Material: Immediate and Serious Effects-Toxic

Class D2B: Poisonous and Infectious Material: Other Effects-Toxic







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15. REGULATORY INFORMATION (Continued)

EUROPEAN COMMUNITY INFORMATION FOR PRODUCT:

EC LABELING AND CLASSIFICATION: The following information is for acetonitrile, which is considered hazardous under EC Classification requirements:

Acetonitrile:

EC EINECS/ELINCS NUMBER: 200-83-5

HAZARD CLASSIFICATION: [F] Highly Flammable. [T]: Toxic.

RISK PHRASES: [R: 11]: Highly Flammable. [R: 23/24/25]: Toxic by inhalation, in contact with skin, and if swallowed. SAFETY PHRASES: [S: 2½-]: Keep out of reach of children. (*This safety phrase can be omitted from the label when the substance or preparation is sold for industrial use only.*) [S: 16]: Keep away from sources of ignition – No smoking. [S: 27]: Take off immediately all contaminated clothing. [S: 45]: In case of accident, or if you feel unwell, seek medical advice immediately (show label where possible).

SYMBOL:





AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: The components of this product are listed on the AICS.

<u>LIST OF DESIGNATED SUBSTANCES</u>: The acetonitrile component meets the definition the following hazard category, under regulations of Worksafe Australia.

Acetonitrile:

HAZARD CLASSIFICATION: [F] Highly Flammable. [T]: Toxic.

RISK PHRASES: [R: 11]: Highly Flammable. [R: 23/24/25]: Toxic by inhalation, in contact with skin, and if swallowed. SAFETY PHRASES: [S: 2½-]: Keep out of reach of children. (*This safety phrase can be omitted from the label when the substance or preparation is sold for industrial use only.*) [S: 16]: Keep away from sources of ignition – No smoking. [S: 27]: Take off immediately all contaminated clothing. [S: 45]: In case of accident, or if you feel unwell, seek medical advice immediately (show label where possible). SYMBOL:





16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc. PO Box 3519, La Mesa, CA 91944-3519 (619) 670-0609 August 2, 2007

DATE OF PRINTING:

The information contained herein is based on data considered accurate. However, Maxwell Technologies, inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the product if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Maxwell Technologies, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the product even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the product.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

LOQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELs: NIOSH's Recommended Exposure Limits.

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL that was vacated by Court Order.

SKIN: Used when a there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

DEFINITIONS OF TERMS (Continued)

EXPOSURE LIMITS IN AIR (continued):

TLV-Threshold Limit Value: An airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek. IDLH-Immediately Dangerous to Life and Health: This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the

degree of chemical hazards.

HEALTH HAZARD:

0 (Minimal Hazard: No significant health risk, irritation of skin or eyes no anticipated. Skin Imitation: Essentially non-imitating. Pil or Draize = "0". Eye Irritation: Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". Oral Toxicity LDs Ret. < 5000 mg/kg. Dermal Toxicity LDsoRat or Rabbit. < 2000 mg/kg. Inhalation Toxicity 4-hrs LC_{50} Rat: < 20 mg/L.); 1 (Slight Hazard: Minor reversible Injury may occur, slightly or mildly irritating. Skin Irritation: Slightly or mildly irritating. Sylvaniang. Eye Irritation: Slightly or mildly irritating. Oral Toxicity LD_{50} Rat. > 500-5000 mg/kg. Dermal Toxicity LDsoRat or Rabbit: > 1000-2000 mg/kg. Inhalation Toxicity LCso 4-hrs Rat: > 2-20 mg/L); 2 (Moderate Hazard: Temporary or transitory injury may occur. Skin Irritation: Moderately irritating; primary Irritant; sensitizer. PII or Draize > 0, < 5. Eye Irritation: Moderately to severely irritating and/or corrosive; reversible corneal opacity, corneal involvement or imitation clearing in 8-21 days. Draize > 0, ≤ 25. Oral Toxicity LD₅₀ Rat. > 50-500 mg/kg. Dermal Toxicity LD₅₀Rat or Rabbit. > 200-1000 mg/kg. Inhalation Toxicity LC_{50} 4-hrs Rat. > 0.5-2 mg/L.);3 (Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. (continued in following column) Skin Irritation: Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. Pil or Draize > 5 8 with destruction of tissue. Eye Irritation: Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. Oral Toxicity LDso Rat: > 1-50 mg/kg. Dermal Toxicity LDsoRat or Rabbit: > 20-200 mg/kg. Inhalation Toxicity LC₅₀ 4-hrs Rat. > 0.05-0.5 mg/L.); 4 (Severe Hazard: Life-threatening; major or permanent damage may result from single or repeated exposure. Skin Irritation: Not appropriate. Do not rate as a "4", based on skin irritation alone. Eye Irritation: Not appropriate. Do not rate as a *4*, based on eye irritation alone. Oral Toxicity LD_{50} Rat: \leq 1 mg/kg. Dermal Toxicity LD_{50} Rat or Rabbit: \leq 20 mg/kg. Inhalation Toxicity LC_{50} 4hrs Rat; < 0.05 mg/L).

FLAMMABILITY HAZARD:

0 (Minimal Hazard-Materials that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.); 1 (Slight Hazard-Materials that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials (e.g. wood, paper, etc.); 2 (Moderate Hazard-Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, including: Liquids having a flash-point at or above 37.8°C [100°F]; Solid materials in the form of course dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); 3 (Serious Hazard- Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under aimost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; (continued in following column)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD **RATINGS** (continued):

3 (continued): Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids); Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]); 4 (Severe Hazard-Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [a.g. OSHA Class IA; Material that ignite epontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric]).

PHYSICAL HAZARD:

0 (Water Reactivity: Materials that do not react with water. Organic Peroxides: Materials that are normally stable, even under fire conditions and will not react with water. Explosives: Substances that are Non-Explosive. Unstable Compressed Gases: No Rating, Pyrophorics: No Rating. Oxidizers: No "0" rating allowed. Unstable Reactives: Substances that will not polymerize, decompose, condense or self-react.); 1 (Water Reactivity. Materials that change or decompose upon exposure to moisture. Organic Peroxides: Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. Explosives: Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. Compressed Gases: Pressure below OSHA definition. Pyrophorics: No Rating. Oxidizers: Packaging Group III; Sollds: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. Unstable Reactives: Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.); 2 (Water Reactivity: Materials that may react violently with water. Organic Peroxides: Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. Explosives: Division 1.4 -Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. Compressed Gases: Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. Pyrophorics: No Rating. Oxidizers: Packing Group II Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. Unstable Reactives: Substances that may polymertze, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); 3 (Water Reactivity: Materials that may form explosive reactions with water. Organic Peroxides: Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. Explosives: Division 1.2 - Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. Compressed Gases: Pressure ≥ 514.7 psl absolute at 21.1°C (70°F) [500 psig]. Pyrophorics: No Rating. Oxidizers: Packing Group I Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3.:2 potassium bromate/cellulose mixture. Liquids: Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. (continued on following page)

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DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

3 (continued): Unstable Reactives: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); 4 (Water Reactivity: Materials that react explosively with water without requiring heat or confinement. Organic Peroxides: Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. Explosives: Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. Compressed Gases: No Rating. Pyrophorics: Add to the definition of Flammability "4". Oxidizers: No "4" rating. Unstable Reactives: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.). PPE Rating B: Hand and eye protection is required for routine chemical use. PPE Rating C: Hand, eye, and body protection may be required for routine chemical use.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

<u>HEALTH HAZARD</u>: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); <u>HEALTH HAZARD (continued)</u>: 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure could cause death or major residual injury).

FLAMMABILITY HAZARD AND REACTIVITY HAZARD: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: LD₅₀ - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; LC₅₀ - Lethal Concentration (gases) which kills 50% of the exposed animals; ppm concentration expressed in parts of material per million parts of air or water; mg/m³ concentration expressed in weight of substance per volume of air; mg/kg quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include TDLo, the lowest dose to cause a symptom and TCLo the lowest concentration to cause a symptom; TDo, LDLo, and LDo, or TC, TCo, LCLo, and LCo, the lowest dose (or concentration) to cause lethal or toxic effects. Cancer Information: The sources are: IARC - the International Agency for Research on Cancer, NTP - the National Toxicology Program, RTECS - the Registry of Toxic Effects of Chemical Substances, OSHA and CAL/OSHA. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other Information: BEI - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

ECOLOGICAL INFORMATION:

EC is the effect concentration in water. BCF = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. TL_m = median threshold limit; Coefficient of Oil/Water Distribution is represented by $log K_{ow}$ or $log K_{oe}$ and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

U.S. and CANADA:

ACGIH: American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits

This section explains the impact of various laws and regulations on the material. EPA is the U.S. Environmental Protection Agency. NIOSH is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). WHMIS is the Canadian Workplace Hazardous Materials Information System. DOT and TC are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDSL); the U.S. Toxic Substance Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label. OSHA - U.S. Occupational Safety and Health Administration.

EUROPEAN and INTERNATIONAL:

The DFG: This is the Federal Republic of Germany's Occupation Health Agency, similar to the U.S. OSHA. **EC** is the European Community (formerly known as the **EEC**, European Economic Community). **EINECS:** This is the European Inventory of Now-Existing Chemical Substances. The **ARD** is the European Agreement Concerning the International Cardage of Dangerous Goods by Road and the **RID** are the International Regulations Concerning the Carriage of Dangerous Goods by Rail. **AICS** is the Australian Inventory of Chemical Substances.

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Material Safety Data Sheet

Acetonitrile, 99%

ACC# 95494

Section 1 - Chemical Product and Company Identification

MSDS Name: Acetonitrile, 99%

Catalog Numbers: AC149520000, AC149520010, AC149520025, AC149520250,

AC149525000

Synonyms: Cyanomethane; Ethanenitrile; Ethyl nitrile; Methyl cyanide.

Company Identification:

Acros Organics N.V. One Reagent Lane Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01 For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

GAS#	Chemical Name	Percent	EINECS//ELINGS
75-05-8	Acetonitrile	99.0	200-835-2

Hazard Symbols: XN F

Risk Phrases: 11 20/21/22 36

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: 6 deg C. **Warning!** May cause central nervous system depression. May cause liver and kidney damage. May cause reproductive and fetal effects. Lachrymator (substance which increases the flow of tears). Hygroscopic (absorbs moisture from the air). Metabolized to cyanide in the body, which may cause headache, dizziness, weakness, unconsciousness, convulsions, coma and possible death. **Flammable liquid and vapor.** Harmful if swallowed or absorbed through the skin. Causes eye irritation. May cause skin and respiratory tract irritation. May be harmful if inhaled.

Target Organs: Blood, kidneys, central nervous system, liver, lungs.

Potential Health Effects

Eye: Causes eye irritation. Lachrymator (substance which increases the flow of tears). May produce superficial reversible injury.

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Skin: Causes mild skin irritation. Harmful if absorbed through the skin. May be metabolized to cyanide which in turn acts by inhibiting cytochrome oxidase impairing cellular respiration.

Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause effects similar to those for inhalation exposure. May cause tissue anoxia, characterized by weakness, headache, dizziness, confusion, cyanosis (bluish skin due to deficient oxygenation of the blood), weak and irregular heart beat, collapse, unconsciousness, convulsions, coma and death. May cause central nervous system depression. Metabolism may release cyanide, which may result in headache, dizziness, weakness, collapse, unconsciousness and possible death.

Inhalation: Aspiration may lead to pulmonary edema. Vapors may cause dizziness or suffocation. Causes upper respiratory tract irritation. May be metabolized to cyanide which in turns act by inhibiting cytochrome oxidase impairing cellular respiration. May cause tissue anoxia, characterized by weakness, headache, dizziness, confusion, cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood), weak and irregular heart beat, collapse, unconsciousness, convulsions, coma and death.

Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. May cause liver and kidney damage. May be metabolized to cyanide which in turn acts by inhibiting cytochrome oxidase impairing cellular respiration. Animal studies have reported that fetal effects/abnormalities may occur when maternal toxicity is seen. Laboratory experiments have resulted in mutagenic effects. Exposure to small amounts of cyanide compounds over long periods of time is reported to cause loss of appetite, headache, weakness, nausea, dizziness, and symptoms of irritation of the upper respiratory tract and eyes.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed.

Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.

Notes to Physician: Exposure should be treated as a cyanide poisoning. Effects may be delayed. For methemoglobinemia, administer oxygen alone or with Methylene blue depending on the methemoglobinemia concentration in the blood. May be partially metabolized to cyanide in the body.

Antidote: Always have a cyanide antidote kit on hand when working with cyanide compounds. Get medical advice to use. Methylene blue, alone or in combination with oxygen is indicated as a treatment in nitrite induced methemoglobinemia.

Section 5 - Fire Fighting Measures

General Information: Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Vapors may form an explosive mixture with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Flammable liquid and vapor. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water. For large fires, use dry

chemical, carbon dioxide, alcohol-resistant foam, or water spray. Cool containers with flooding quantities of water until well after fire is out.

Flash Point: 6 deg C (42.80 deg F)

Autoignition Temperature: 524 deg C (975.20 deg F)

Explosion Limits, Lower: 4.4 vol %

Upper: 16.00 vol %

NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Absorb spill using an absorbent, noncombustible material such as earth, sand, or vermiculite. Do not use combustible materials such as saw dust. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces. Approach spill from upwind.

Section 7 - Handling and Storage

Handling: Remove contaminated clothing and wash before reuse. Use only in a wellventilated area. Ground and bond containers when transferring material. Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Empty

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containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Do not ingest or inhale. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Store protected from moisture.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Ghemical Name	ACOIL	NIOSH	OSIA - Final Pals
Acetonitrile	20 ppm TWA; skin - potential for cutaneous absorption	20 ppm TWA; 34 mg/m3 TWA 500 ppm IDLH	40 ppm TWA; 70 mg/m3 TWA

OSHA Vacated PELs: Acetonitrile: 40 ppm TWA; 70 mg/m3 TWA

Personal Protective Equipment Eves: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed

whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless

Odor: sweetish odor - ethereal odor

pH: Not available.

Vapor Pressure: 73 mm Hg Vapor Density: 1.42 (Air=1)

Evaporation Rate: 5.79 (Butyl acetate=1)

Viscosity: 0.36 cP 20 deg C

Boiling Point: 82 deg C @ 760.00mm Hg Freezing/Melting Point:-50 deg C

Decomposition Temperature: > 500 deg C

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Solubility: Miscible.

Specific Gravity/Density:.7810g/cm3

Molecular Formula:C2H3N Molecular Weight:41.04

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures. **Conditions to Avoid:** Incompatible materials, ignition sources, excess heat, exposure to moist air or water, oxidizers.

Incompatibilities with Other Materials: Oxidizing agents, reducing agents, acids, bases, alkali metals, fluorine, nitric acid, perchlorates, sulfuric acid, chlorosulfonic acid, oleum, dinitrogen tetraoxide, sulfites, indium, moisture, Attacks some forms of plastics, rubbers, and coatings., nitrating agents, N-fluoro compounds (e.g. perfluorourea + acetonitrile), lanthanide perchlorates, iron (III) perchlorate, 2-Cyano-2-propyl nitrate, trichlorosilane, diphenyl sulfoxide.

Hazardous Decomposition Products: Hydrogen cyanide, nitrogen oxides, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.

Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:

CAS# 75-05-8: AL7700000

LD50/LC50: CAS# 75-05-8:

Draize test, rabbit, eye: 100 uL/24H Moderate; Inhalation, mouse: LC50 = 2693 ppm/1H; Inhalation, rabbit: LC50 = 2828 ppm/4H; Inhalation, rat: LC50 = 7551 ppm/8H; Oral, mouse: LD50 = 269 mg/kg; Oral, rabbit: LD50 = 50 mg/kg; Oral, rat: LD50 = 2460 mg/kg;

Skin, rabbit: LD50 = >2 gm/kg; <BR.

Carcinogenicity:

CAS# 75-05-8:

ACGIH: A4 - Not Classifiable as a Human Carcinogen

Epidemiology: No information available.

Teratogenicity: Embryo or Fetus-stunted fetus: Inhalation, hamster: TCLo=8000 ppm/1H (female 8 days after conception).; Specific Developmental Abnormalities - musculoskeletal: Oral, hamster TCLo = 300 mg/kg (female 8 days after conception).

Reproductive Effects: Fertility - post-implantation mortality: Oral, hamster:

TDLo=400 mg/kg and Inhalation, hamster TCLo=5000 ppm/1H (female 8 days after

conception).

Neurotoxicity: No information available.

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Mutagenicity: Sex Chromosome Loss/Non-disjunction: Saccharomyces cerevisiae = 47600 ppm and Drosophila melongaster = 131 ppm.; Sister Chromatid Exchange: Hamster, ovary = 5 gm/L.; Inhalation, rat: TDL0 = 400 ppm/6H/24-I (produced liver tumors)

Other Studies: Open irritation test: Administration onto the skin (rabbit) = 500 mg (Mild).

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 1150 ppm; 24 Hr; TLm (hard water) Fathead Minnow: 1000 mg/L; 96 Hr; TLm (soft water) Bluegill/Sunfish: 1850 mg/L; 96 Hr; TLm (soft water) Fathead Minnow: 1640 mg/L; 96 Hr; LC50 (flow-bioassay) Fathead Minnow: 1640 mg/L; 96 Hr; EC50 (flow-bioassay) No data available. **Environmental:** Estimated Koc value = 16. Acetonitrile is expected to weakly adsorb to most soils based on the Koc value. Volitization from soil surfaces and leaching into ground water is expected to be significant. Estimated BCF value = 0.3. This value indicates that acetonitrile will not significantly bioconcentrate in aquatic organisms or adsorb to suspended solids and sediments in water. Acetonitrile is unreactive towards photochemically-generated free radicals and direct photolysis in the gaseous phase.

Physical: No information available.

Other: Biodegradable.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: CAS# 75-05-8: waste number U003 (Ignitable waste, Toxic waste).

Section 14 - Transport Information

	w w	IATA	REDY ADR	IMO	ලකාකුල්ක ලබා
Shipping Name:	ACETONITRILE		-		No information available.
Hazard Class:	3				
UN Number:	UN1648				

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Packing	77		
Group:			<u> </u>

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 75-05-8 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 75-05-8: Effective Date: 10/4/82; Sunset Date: 10/4/92

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

CERCLA Hazardous Substances and corresponding RQs

CAS# 75-05-8: 5000 lb final RQ; 2270 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 75-05-8: acute, chronic, flammable.

Section 313

This material contains Acetonitrile (CAS# 75-05-8, 99 0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 75-05-8 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 75-05-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

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European Labeling in Accordance with EC Directives Hazard Symbols:

XN F

Risk Phrases:

R 11 Highly flammable. R 20/21/22 Harmful by inhalation, in contact with skin and if swallowed. R 36 Irritating to eyes.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.
S 36/37 Wear suitable protective clothing and gloves.

WGK (Water Danger/Protection)

CAS# 75-05-8: 2

Canada - DSL/NDSL

CAS# 75-05-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D1B, D2B.

Canadian Ingredient Disclosure List

CAS# 75-05-8 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 75-05-8: OEL-ARAB Republic of Egypt:TWA 40 ppm (70 mg/m3);Skin OEL-AUSTRALIA:TWA 40 ppm (70 mg/m3);STEL 60 ppm ;Skin OEL-AUSTRIA:TW A 40 ppm (70 mg/m3) OEL-BELGIUM:TWA 40 ppm (67 mg/m3);STEL 60 ppm (10 mg/m3);Skin OEL-DENMARK:TWA 40 ppm (70 mg/m3);STEL 60 ppm (10 mg/m3) OEL-FINLAND:TWA 40 ppm (70 mg/m3);STEL 60 ppm (10 mg/m3) OEL-FRANCE :TWA 40 ppm (70 mg/m3) OEL-GERMANY:TWA 40 ppm (70 mg/m3) OEL-HUNGARY :TWA 50 mg/m3;STEL 100 mg/m3;Skin JAN9 OEL-THE NETHERLANDS:TWA 40 ppm (70 mg/m3) OEL-THE PHILIPPINES:TWA 40 ppm (70 mg/m3) OEL-RUSSIA:STE L 10 mg/m3 OEL-SWITZERLAND:TWA 40 ppm (70 mg/m3);STEL 80 ppm ;Skin O EL-TURKEY:TWA 40 ppm (70 mg/m3) OEL-UNITED KINGDOM:TWA 40 ppm (70 mg/m3);STEL 60 ppm OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 1/20/1998 Revision #6 Date: 6/04/2002

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages

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ATTACHMENT C
CONTRACTOR DOs and DON'Ts

Environmental Dos & Don'ts

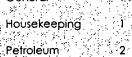


Hawaiian Electric Company, Inc. P.O. Box 2750, Honolulu, HI 96840-0001

Ver.12/2006

Hawaiian Electric
Company; Inc. (HECO)
and its subsidiaries
Hawaiian Electric Light
Company, Inc. (HELCO)
and Maui Electric
Company, Ltd. (MECO),
are herein referred to as
Company.

Purpose: To inform contractors of the Company's expectations and requirements.



& Chemicals

Waste Generation 2

Wash & Waste 3. water Generation

Releases 3,

Fuel Burning 3 Equipment

True or False Quiz 4

Important Numbers 4







General

Check that your equipment is in proper working condition (e.g., no leaks, smoking exhaust or missing parts, etc.). Repair or replace defective equipment before coming onsite.

Consider factors such as time of day, sensitive areas (e.g., residential) to ensure your activities do not cause noise, smoke, dust, vibration, or odors which could be considered a public nuisance. Obtain a noise permit or variance if necessary.



Notify the Company of any subcontractors you will be using. DO NOT allow a subcontractor to work on a job without prior approval from your Company contact. Contractors will be held responsible for the actions of their subcontractors based on the Company's contract service agreement.

DO NOT perform any unauthorized changes to your work plan. Talk to your Company Contact about any changes or if you have questions.

Housekeeping

Maintain a clean and orderly work area and monitor your job for leaks, strange odors and conditions.

Inspect your job site at the end of each day/shift to ensure that all areas are clean.

Protect the storm drains!! Only rainwater is permitted. DO NOT allow anything else to enter, including city water. This means:

- No hosing down work areas or equipment.
- Keeping areas clean and placing materials undercover to prevent rainwater from being contaminated and the runoff

- from entering the drains.
- Placing materials, parking vehicles and performing activities away from drains.
- Blocking drains when necessary.

Throw only garbage (e.g., food, paper) in trash receptacles. DO NOT throw in the trash items such as:

- Aerosol cans;
- Batteries and lamps; and
- Chemicals (paints, pesticides, petroleum products, solvents).

Ask for assistance.

Keep dumpsters closed or covered unless in use.

Environmental Dos & Don'ts for Contractors



Containers must have

labels identifying their

contents. Minimize

potential for releases by

placing containers on

containment.

You must determine if

the waste generated is.

hazardous or non-

hazardous. If in doubt,

DO NOT throw it out.

Ask for assistance.

Petroleum and Chemical Use

Use non-hazardous chemicals.

Obtain approval from your

Company contact if materials that
contain hazardous constituents
must be used.

Use containers that are in good condition with a legible label identifying its contents.

Monitor your job for leaks, strange odors or conditions that could lead to a discharge or release.

Use portable spill containment when loading or unloading chemicals and oil-related products in areas without permanent containment.

Use drips pans or other devices to collect spills of paints, solvents, and other liquid materials.

Consider any adverse affects that your job may have on the surrounding area. Note weather conditions (in particular wind speed and direction) and adjust your operations as appropriate to the weather conditions.

Remove all unused materials (paints, solvents, etc.) prior to job completion. DO NOT leave excess materials onsite unless you received prior approval and coordinated the storage location with your Company contact.

Waste Generation

Use drums and containers that are in good condition. Do not use drums with:

- Excessive rusting
- Holes in the seams or any leaks;
- Severe dents; or
- Missing bolt, ring, lid, or bung.

Properly label all containers. At a minimum the container must be clearly and permanently marked with the date and contents.

Determine control measures to be used to prevent releases and to contain any unexpected releases. Use tarps, drips pans, or other collection devices to collect solid wastes (produced by sanding, painting, etc.) or spills of paints, solvents, and other liquid materials.

Coordinate the storage and disposal of wastes (paint chips, sandblast, soil, etc.) with your Company contact. You must:

- Arrange for a storage location.
- Inform your Company contact if you plan to transport the wastes offsite and get approval for the disposal location. DO NOT transport wastes from the facility without appropriate documentation (hazardous waste manifest; bill of lading, etc.) and applicable placarding.

You must manage all wastes generated according to State and Federal regulations.

3

Wash & Wastewater Generation

DO NOT permit anything but rainwater to enter <u>storm drains</u>. Stop if your work causes water to head towards a drain.

Consider dry cleaning methods (e.g., sweeping, wiping) instead of using running water. DO NOT wash equipment or vehicles without an approved plan to collect and treat the wash water.

Wipe down equipment and DO NOT wash hand tools or equipment in bathroom sinks.

Utilize best management practices for dewatering work. Dewatering practices and disposal measures must be pre-approved by the Company's Environmental Department. A dewatering permit may also be required.



Keeping work areas
clean of debris and grit
prevents contaminants
from being picked up

by rainfall runoff.

Be prepared. Avoid spills by using drip pans, absorbent material or ground cloths. Empty drip pans and replace absorbent materials.

promptly.

Releases

Have appropriate spill clean up equipment near your work area.

Stop and contain spills and leaks if it is safe to do so.

Leave the danger area immediately if the situation is an emergency,

Notify your Company contact if a release occurs or is discovered (including encountering free product or petroleum contaminated soil). For emergencies, call the Shift Supervisor (at Power Plants) or Dispatch (at Baseyards and

other non power plant locations). Direct verbal contact must be made. DO NOT just leave a phone message. Keep calling the numbers provided until you are able to speak to someone from the Company.

Block the storm drain if anything but rainwater is headed toward it.

DO NOT wash spills into storm drains or sanitary sewers.

Place spill materials (e.g., used absorbents or rags) in appropriate containers that are properly labeled and clean.

Fuel Burning Equipment

Inform your Company contact if you need to bring equipment that uses fuel (compressors, generators, etc.) onto a <u>Power Plant</u> facility.

Instructions on how long you can use the equipment will be provided. Note: calculations will be done to determine when air permitting requirements will be triggered.

4 Environmental Dos & Don'ts for Contractors

True or False Quiz

Remember,

Fix leaky equipment



 Equipment can be rinsed over the Company's drains.

T or F

 Debris such as sand, sawdust, scrap metal and metal shavings on the ground must, at a minimum, be cleaned up daily.
 T or F

Environmental – Air

Issues

- All containers must have legible labels identifying their contents.
 T or F
- 4. It is always good to leave excess materials behind so the Company can use them for other projects.

 T or F
- Aerosol cans such as spray paint and WD 40 are NOT allowed in the Company's trash even when empty.
 - T or F

(808) 722-0866 (cell)

(808) 721-5537 (cell)

(808) 543-4522 (office)

 In the event of a spill, a phone message qualifies as notification.

T or F

Important Numbers - HECO

Store items undercover and on containment



DO NOT abandon materials



Position/Name	Name	Number
Your HECO Company Contact	{fill in}	
	Power Plants	
	On Duty Person	
Supervisor		Kahe: (808) 543-4150 or 4185
		Waiau: (808) 543-4209
Facility Environmental	Glenn Murata	(808) 543-4249 (office)
Representative		(808) 351-3715 (cell)
Security	On Duty Person	Honolulu: (808) 543-4569
		Kahe: (808) 543-4169
		Waiau: (808) 543-4269
्रेट के अंदिर हैं। इस रिक्र Ba i	seyards and Other	Locations
Security Command Cntr		
Facility Environmental	Mike Choy	(808) 543-4220 (office)
Representative		(808) 349-6484 (cell)
The Cott	ner Contacts for All	(808) 349-6484 (cell) Locations
Safety	Main Line	(808) 543-4462
Safety	Rick Ravelo	(808) 543-7073 (office)
		(808) 864-4535 (cell)
Safety	Troy Tau'a	(808) 543-7072 (office)
		(808) 590-9407 (cell)
Environmental – Water	Kirk Tomita	(808) 543-4528 (office)
Issues		(808) 352-0970 (cell)
Environmental – Waste	Dave Kaneko	(808) 543-4524 (office)
Issues		(808) 542-5439 (cell)
Environmental – PCB	Andy Keith	(808) 543-4523 (office)

Nathan Yuen

HECO T-6 ATTACHMENT 5 (M) PAGE 1 OF 2 AUGUST 2007 SUPPLEMENT

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840



Karl Stahlkopf, PhD Senior Vice President Energy Solutions and Chief Technology Officer

July 20, 2007

Dr. Richard Rocheleau
Director, Hawaii Natural Energy Institute
University of Hawaii at Manoa
1680 East West Road
Honolulu, HI 96822

Subject: DE-PS26-07NT43119-02, Letter of Commitment for HNEI Proposal, "Managing a Distribution System for Service Quality and Reliability, Peak Load Reduction, and Grid Support"

Dear Dr. Rocheleau:

Hawaiian Electric Company, Inc., (HECO) welcomes the opportunity to participate with the Hawaii Natural Energy Institute (HNEI), Maui Electric Company, Limited, and the other partners in your proposal to the U.S. Department of Energy in response to Solicitation Number DE-PS26-07NT43119-02. The project concept, as described in detail in the proposal, is to develop and demonstrate a distribution management system (DMS) capable of integrating various distributed energy technologies on a distribution feeder, such that peak load on the feeder may be reduced and the feeder may be "dispatched" by a central grid energy management system. In this way, the value provided by the various distributed resources to the utility may be better optimized.

A primary objective of ours is to mitigate grid impacts caused by large intermittent wind farms. The dispatchable feeder would operate in conjunction with other equipment, such as energy storage and/or an electronic shock absorber described below, to help stabilize the grid. HECO views this project as a key opportunity to support further development of renewable energy and distributed energy resources on our island grids.

If the project proceeds as proposed, HECO can contribute to the project in the following manner:

 HECO Electronic Shock Absorber R&D. HECO plans to fund research and development to refine the design of the electronic shock absorber (ESA) technology. The ESA, patented by HECO, will help mitigate short duration impacts (frequency,

HECO T-6 ATTACHMENT 5 (M) PAGE 2 OF 2 AUGUST 2007 SUPPLEMENT

Dr. Richard Rocheleau July 20, 2007 Page 2

voltage, etc.) of intermittent renewables and, in conjunction with the dispatchable feeder and potential wind farm energy storage systems, maintain grid stability. HECO will spend up to \$221,000 in ESA R&D in each of the years 2008-2010, and will provide part or all of this as cost share. The actual amount of cost share will depend on final statements of work developed between HECO, HNEI, and USDOE.

Advanced Metering Infrastructure. The HNEI proposal includes integration of advanced
metering infrastructure (AMI) and demand response technologies with other resources.
HECO would provide \$100,000 in the form of AMI data transfer gained from HECO's
AMI pilot on Oahu.

Based on the above, HECO would provide up to \$763,000 in funding or in-kind contributions in support of the proposed project. In addition, HECO will provide additional manpower resources supporting the above project components, and helping administer the overall project. Formal commitment of these contributions will be dependent upon negotiation of mutually acceptable agreements between HECO, HNEI, and other project participants, and upon approval of the Hawaii Public Utilities Commission, as applicable.

We look forward to working with HNEI on this important initiative.

Sincerely,

cc: E. Reinhardt

Race & Wattleng



HECO T-6 ATTACHMENT 5 (N) PAGE 1 OF 2 AUGUST 2007 SUPPLEMENT

BEYOND SUN POWER: AN ENTERPRISE APPROACH TO ENERGY AND LEARNING SOLUTIONS

Draft Statement of Work

DESCRIPTION

Evaluate the effectiveness of direct current (DC) fluorescent electronic ballasts designed to fit in standard linear fluorescent lighting fixtures housing one or two T8 fluorescent lamps in a classroom situation. The ballasts, in conjunction with classroom occupancy sensors, are intended to maximize the efficiency of photo-voltaic (PV) solar cells. An enterprise web-based solutions approach will be simultaneously deployed to monitor the PV/lighting system as well as to provide access to remote learning resources in real time.

BACKGROUND

Hawaiian Electric Company, Inc. has supported Hawaii's K-12 learning institutions in the past by partially funding and providing engineering and project management support in the installation of solar photo-voltaic (PV) power systems through our Sun Power for Schools program. We now have the opportunity to take our commitment toward the careful utilization of renewable energy resources a step further by the deployment of innovative technology that efficiently converts direct current (DC) power delivered by PV panels to energy efficient linear fluorescent T8 lamps. This leading-edge technology in DC electronic ballasts has been developed by Nextek Power Systems, Inc. and includes intelligent power supply modules that provide make-up power from the HECO grid during periods of insufficient supply from the PV system. The ballasts will also integrate with occupancy sensors to maximize energy savings. The intelligence of the system is further demonstrated in a web-based monitoring and archiving application that gives the end-user feedback on renewable energy resource availability, indoor lighting usage patterns, and data that may applicable for preventative maintenance.

As the DC ballast system requires IP connectivity, other applications to enhance the learning environment can be easily dovetailed with this "kernel" in a synergistic approach, namely:

- Provide and install a wireless local area network to demonstrate high-speed broadband connectivity independent of a traditional hard-wired Ethernet LAN.
- Implement a web-based learning system through the use of video conferencing technology. This
 technology, already well-established in the business environment, will demonstrate real-time
 access to hosted learning resources not readily available at the remote site.

The site identified for this project would need to fit a few criteria. Ideally, this site would be a learning center with approximately 1 kW of lighting demand designated to be powered from a PV source that is provided under the scope of this project. We have assumed that a high-speed broadband service connection (either cable or DSL) is readily available. To host the web-based learning environment, a host classroom setting would be selected and outfitted with the required webcam and PC equipment provided under this project scope. Accordingly, the remote site would be outfitted with the required webcam and PC equipment. Hosting of the web-based Nextek monitoring system, as well as the web-based video conferencing system will be contracted to outside vendors.

OBJECTIVES

This project has 6 objectives designed to maximize classroom energy and learning efficiency:

HECO T-6 ATTACHMENT 5 (N) PAGE 2 OF 2 AUGUST 2007 SUPPLEMENT

- Evaluate the effectiveness of direct current (DC) fluorescent electronic ballasts designed to fit in standard linear fluorescent lighting fixtures housing one or two T8 fluorescent lamps. The ballasts are designed to maximize the efficiency of photo-voltaic (PV) solar cells.
- Couple the DC fluorescent ballasts with occupancy sensors to maximize energy savings of the lighting system.
- Install a dedicated PV system for the fluorescent lighting with a smart power supply that can modulate HECO grid power during times of insufficient PV power. The power supply will also have the capability of interfacing with a web-based monitoring system.
- Demonstrate a web-based monitoring human-machine interface application to increase end-user awareness of energy usage patterns of the classroom lighting system. The application will also be a preventative maintenance tool for the PV system.
- Demonstrate a wireless IP network system to reduce wiring costs within a classroom building for local area networking with high-speed broadband capability.
- Demonstrate a web-based learning environment between a host site and the remote classroom building. Video conferencing technology will be used to provide real-time access to learning resources not readily available at the remote classroom location.

Funding Requested

TC --\$31,434 HECO cost match -- \$31,434 EPRI leverage -- \$16,710

Total--\$79,578

HECO T-6 ATTACHMENT 5 (O) PAGE 1 OF 17 AUGUST 2007 SUPPLEMENT

AGREEMENT NO. PNR-07-001-01-01-01

CONSULTANT SERVICES AGREEMENT

THIS CONSULTANT SERVICES AGREEMENT (hereinafter "Agreement" or "Contract") is made on June 1, 2007 by and between HAWAIIAN ELECTRIC COMPANY, INC. (hereinafter "Company"), a Hawaii corporation, whose principal place of business and address is 900 Richards Street, Honolulu, Hawaii 96813 and whose mailing address is P. O. Box 2750, Honolulu, Hawaii 96840-0001 and UNIVERSITY OF HAWAII (hereinafter "Consultant"), whose principal place of business and mailing address is Office of Research Services, 2530 Dole Street, Sakamaki Hall D-200, Honolulu, Hawaii, 96822.

<u>WITNESSETH:</u>

WHEREAS, Company is in the business of generation, transmission, and distribution of electrical power on the Island of Oahu, State of Hawaii; and

WHEREAS, Company requires certain professional consulting work to be accomplished in order to evaluate advanced photovoltaic technologies; and

WHEREAS, Consultant is in the business of performing professional consulting work such as that needed by Company; and

WHEREAS, Consultant represents that it is equipped and has the expertise necessary to perform the particular professional consulting work required under this Agreement.

NOW, THEREFORE, in consideration of these premises and of the mutual promises herein contained, Company and Consultant hereby agree that Consultant will perform professional consulting work for Company under the following terms and conditions:

I. SCOPE OF WORK

- 1.1 Project Description Consultant agrees to furnish all labor, tools, materials, equipment, meals, lodging, transportation, and supervision necessary to complete the following work in a professional manner and to the reasonable satisfaction of Company: Data Acquisition System Troubleshooting, Repair, Monitoring, and Maintenance of Photovoltaic Systems, as described in the attached Special Conditions at Attachment A, to be performed by Consultant's Hawaii Natural Energy Institute (hereinafter "Work"). The Special Conditions at Attachment A shall take precedence over any conflicting provisions found in this Contract.
- 1.2 Term The Term of this Contract shall be from June 1, 2007 until December 31, 2008, unless terminated by written amendment hereto,

II. COMPENSATION

- 2.1 <u>Time and Expenses</u> Compensation for Work performed and expenses incurred under this Contract shall be on a time and expenses basis. The hourly rates for the Work will be at a mutually agreeable rate and Consultant shall advise Company of hardware expenditures prior to procuring hardware. However, in no event shall the total time and expenses invoiced under this Contract inclusive of taxes exceed the sum of \$30,000.00.
- 2.2 <u>Invoicing</u> Consultant may submit invoices for Work completed by Consultant and shall reference the Company's Designated Representative, the Company service order or service contract number, if any, and any additional information required as part of the Scope of Work hereunder. All invoices should be addressed as follows:

Hawaiian Electric Company, Inc. P. O. Box 2750

P. U. BOX 2750

Honolulu, Hawaii 96840-0001 Attention: Accounts Payable

cention: Accounts Payable

Agreement No. PNR-07-001-01-01

NOTE: Do not include the name of the Company's Designated Representative in the address.

The ORIGINAL invoice, without attachments, must be sent directly to the Accounts Payable address listed above. ALL REQUIRED SUPPORTING DOCUMENTATION must be sent SEPARATELY to the Company's Designated Representative. Failure to follow this procedure may cause a delay in payment.

- 2.3 <u>Payments</u> Payment of a properly submitted invoice will be made within thirty (30) days after receipt and approval by Company.
- 2.4 Final Payment Final payment of all remaining amounts due Consultant, including any and all retentions, shall be paid within sixty (60) days after all Work is completed, accepted by Company, and a proper final invoice submitted; provided, however, that payment shall be made within thirty (30) days if Company is satisfied by bond or otherwise that there are no outstanding third-party claims against the Work.
- 2.5 Withholding of Payments; Set-off All payments, including the final payment, are subject to adjustment during or after termination of the Work on the basis of any final accounting which may be made by Company. Company may withhold from any payment, including the final payment: (1) any amount incorrectly invoiced; or (2) any amount in dispute either because Company has found the invoice excessive, or the Work performed unacceptable. Company further reserves the right to set-off any amounts due from Consultant, or any affiliated company of Consultant, to Company or any of its affiliated companies, against any amounts payable at any time by Company in connection with this Agreement. "Affiliated company" refers to any corporation, firm or association that controls, is controlled by or is under common control with Company or Consultant, as the case may be.

III. STATUS OF THE PARTIES

- 3.1 <u>Independent Contractor</u> Consultant will act solely as an independent contractor of Company, and not as Company's agent or servant for any purpose. All employees of Consultant will work under the supervision of Consultant and not act as Company's agents or servants for any purpose.
- 3.2 Subletting or Assigning Contract Consultant shall not assign nor sublet any portion of the Work under this Contract without first submitting the proposed subcontract or assignment to Company's Designated Representative and receiving written consent from such Representative to subcontract or assign, which consent may be granted or withheld in Company's sole discretion. A request to sublet or assign must contain the name and location of individuals or firms to whom Work will be transferred, information on the qualifications and experience of those individuals or firms to perform the transferred Work, and an estimate of the cost of Work to be performed by the subcontractor or assignee. Consultant shall ensure that the general terms and conditions of this Contract and any Contract amendment regarding the Work to be performed are

incorporated into and attached to any subcontract or assignment. Company's consent to subletting or assignment shall not relieve Consultant of responsibility for the performance of the Work in accordance with the terms and conditions of this Contract, and any amendments thereto.

IV. POINTS OF CONTACT

- 4.1 <u>Company's Designated Representative</u> As used in this Contract, "Company's Designated Representative" shall mean Darren Ishimura. During the performance of the Work hereunder, he can be reached at the Company corporate offices in Honolulu, Hawaii. He shall be the point of contact for and have the authority to speak on behalf of Company concerning all matters related to this Contract, except that he shall not have the authority to amend the Contract.
- 4.2 Consultant's Designated Representative As used in this Contract, "Consultant's Designated Representative" shall mean Yaa-Yin Fong, or her authorized designee. During the performance of the Work hereunder, she can be reached at the Consultant offices in Honolulu, Hawaii. She shall be the point of contact for and have the authority to speak on behalf of Consultant concerning all administrative matters related to this Contract.
- 4.3 <u>Consultant's Key Personnel</u> The following individuals are designated as Key Personnel under this Contract:
 - i) Eric Miller (Principal Investigator)
 - ii) Bjorn Marsen (Co-Principal Investigator)

V. PERFORMANCE STANDARDS AND WARRANTY

- 5.1 Performance Standards In selecting employees to undertake the Work under this Contract, Consultant shall select only those persons who are qualified by the necessary education, training and experience to provide high quality performance of the particular Work for which each such employee is responsible. Consultant shall accomplish all Work in a professional manner and to the reasonable satisfaction of Company. Consultant's personnel shall exercise that degree of skill and care required by the highest level of accepted professional standards in Consultant's field.
 - 5.2 Technological Developments and Remedies Omitted.
- 5.3 Correction of Defective or Substandard Work Consultant acknowledges its responsibility for insuring that the procedures

used in the performance of this Contract are sufficient to satisfactorily accomplish the Work, and that review and approval by Company of any drawings, specifications or other documents prepared by Consultant in the performance of the Work shall not relieve Consultant or any of its subcontractors or vendors of its professional responsibility for the Work. Consultant will be held to standards consistent to the industry.

5.4 <u>Replacement of Key Personnel</u> - Due to the critical nature of Company's operations, Consultant agrees that prior written approval must be obtained from Company for any change in Consultant's Key Personnel. Consultant will submit to Company a written request and resume, curriculum vitae, or other information relevant to the replacement's qualifications.

VI. INSURANCE AND RESPONSIBILITY

- 6.1 Workers' Compensation Consultant and anyone acting under its direction or control or on its behalf shall at its own expense procure and maintain in full force at all times during the term of this Contract, Workers' Compensation, Temporary Disability, and other similar insurance required by state or federal laws. Such insurance may be on a self-insured basis.
 - 6.2 <u>Commercial General Liability Insurance</u> Omitted.
 - 6.3 Automobile Liability Insurance Omitted.
 - 6.4 Professional Errors and Omissions Insurance Omitted.
- 6.5 Consultant's Pollution Liability Insurance and/or Asbestos Abatement Liability Insurance and/or Lead Abatement Liability Insurance Omitted.
 - 6.6 Marine Insurance Omitted.
 - 6.7 Waiver of Subrogation Omitted.
 - 6.8 Company as Additional Insured Omitted.
- 6.9 Statements of Self-Insurance Upon request, Consultant shall file with the Company's Designated Representative statements of self-insurance certifying that required insurance coverage is in force, and further providing that the Company will be given thirty (30) days' written notice of any material change in, cancellation of, or intent not to renew any of the policies. Receipt of any statement showing less coverage than requested is not a waiver of the Consultant's obligation to fulfill the requirements.

6.10 Responsibility - The University of Hawaii shall be responsible for damages or injury caused by the University of Hawaii's agents, officers, and employees in the course of their employment under this Agreement to the extent that the University of Hawaii's liability for such damage or injury has been determined by a court or otherwise agreed to by the University of Hawaii, and the University of Hawaii shall pay for such damages and injury to the extent permitted by law and approved by the Hawaii Legislature.

VII. CONFIDENTIALITY, OWNERSHIP, AND USE OF MATERIALS AND INFORMATION.

- 7.1 <u>Company Confidential Information</u> Except as otherwise Provided, any written information that is labeled as "Confidential" by Company related to Company business, including but not limited to drawings, documents, technical data, business information, Customer/client information, or any other type of information Whatsoever, whether or not characterized as secret or confidential, Obtained by Consultant from Company under this Agreement is Company's exclusive property and shall be deemed Company's Confidential Information. Consultant shall receive and maintain Company's Confidential Information in the strictest confidence. Company's Confidential Information shall also include Compilation, modification, restatement, analysis, reworking, evaluation, report, or other expression of Company's confidential information labeled as Confidential and provided by Company to Consultant under this Agreement. Consultant shall not use Company's Confidential Information for any purpose other than the Work and shall not otherwise disclose Company's Confidential Information to others except with the Company's consent given in Writing. Upon request of Company, Consultant shall return all Copies of all Company's Confidential Information to Company upon Completion of the Work except that Consultant may retain one copy . in a secure storage for archival purposes.
- 7.2 <u>Excluded Information</u> Company Confidential Information Shall not include, and Consultant shall have no obligation to maintain in confidence, any information that:
 - a. Is presently known to Consultant without a pledge of confidentiality to Company;
 - b. Is presently in the public domain;
 - c. Was received from third parties with no obligation of confidentiality to Company; or
 - d. Is required to be disclosed by law, court order or regulation.
 - 7.3 Discoveries and Inventions Omitted.

- 7.4 Assignment of Copyright and Discoveries Omitted.
- 7.5 Previous Discoveries. Omitted. .
- 7.6 Exclusive Use and Proprietary Ownership Any reports or documents prepared by Consultant in fulfillment of its obligations to the Work shall be considered Company proprietary information and Consultant hereby grants to Company and its subsidiaries an exclusive, paid-up, royalty-free license to use such reports or documents or information contained therein for any and all business purposes of Company and its subsidiaries, affiliates, partners, and associates including planning, research, regulatory, operational and commercial purposes. Notwithstanding the foregoing, Consultant shall retain ownership rights in all data, research results, compilations, evaluations, analyses, and other forms of information that do not constitute Company Confidential Information and that are gathered, collected, and produced by Consultant ("Consultant Proprietary Information") under this Agreement or during the Work. Further, Consultant shall retain ownership rights in all models, methods, procedures, computer software code, know-how, and any other form of intellectual property, whether patentable or not, conceived and/or reduced to practice under this Agreement or during Work ("Consultant Intellectual Property"). acknowledges Consultants right to use Consultant Proprietary Information and Consultant Intellectual Property for its own purposes, including but not limited to academic, public service, consulting, and commercial purposes. Notwithstanding foregoing, Consultant may not use, distribute, or publish any of those reports or documents that are prepared on behalf of Company under this Agreement and during the Work for any purpose without Company approval of each and every proposed use or distribution. This requirement shall survive the expiration or termination of this Agreement and the Work.

All right, title and ownership of the LPG reformer and all other equipment required hereunder (the "LPG Equipment") shall vest in the Consultant, provided that LPG Equipment shall be used exclusively for the Work until the Work is completed.

7.7 Term of Confidentiality. The provisions in this Article VII shall survive this Agreement.

VIII. TERMINATION FOR CAUSE

8.1 <u>Conditions Allowing Termination</u> - If any of the following conditions occur during the term of this Contract, then in- such case, Company shall have the right to terminate this Contract as provided in this Article:

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- (1) Consultant fails or is unable to perform its .. obligations under this Contract to the reasonable satisfaction of Company;
- (2) Consultant becomes involved in a labor problem which in the opinion of Company unacceptably impedes or slows down the Work;
- (3) Consultant fails to commence correction of defective Work immediately after notification of defect and to continuously and vigorously pursue correction of defect until the Work is completed to the full satisfaction of Company;
- (4) Consultant makes a general assignment for the benefit of its creditors;
- (5) Consultant has a receiver appointed because of insolvency; or
- (6) Consultant files bankruptcy or has a petition for involuntary bankruptcy filed against it.
- 8.2 <u>Notice Required Before Termination</u> Before terminating this Contract for cause, Company shall give written notice to Consultant of the existence of one of the above conditions allowing termination for cause and of Company's intention to exercise its termination rights if the condition is not corrected to the satisfaction of Company within fifteen (15) days of such notice.
- 8.3 <u>Consultant's Right to Correct Condition</u> Upon receipt of Company's notice of intent to terminate for cause, Consultant shall have fifteen (15) days in which to correct the noted condition to the satisfaction of Company, or, if appropriate, to provide substitute Work which meets all the requirements of this Contract.
- 8.4 Company's Rights Upon Termination If Consultant fails to correct the noted condition within fifteen (15) days, Company may terminate the Contract and secure such substitute Work as it deems necessary to complete the Work under this Contract. In the event Company acquires substitute Work under this provision, Consultant agrees to pay Company upon demand, the reasonable difference between what the substitute Work actually costs Company and what Consultant would have been paid had it completed the Work itself. This provision shall survive termination of this Contract.

IX. TERMINATION FOR CONVENIENCE

- 9.1 Company's Rights Company shall have the right to terminate this Contract at any time for Company's convenience by giving written notice of such to Consultant. Upon receiving notice of termination, Consultant shall discontinue the Work on the date and to the extent specified in the notice and place no further orders for subservices except as needed to continue any portion of the Work which was not terminated. Consultant shall also make every reasonable effort to cancel, upon terms satisfactory to Company, all orders or subcontracts related to the terminated Work.
- 9.2 <u>Termination Prior to Commencement of Work</u> If this Contract is terminated prior to Consultant's having commenced any Work or preparation for Work, no payment shall be made to Consultant.
- 9.3 Termination After Commencement of Work If this Contract is terminated for Company's convenience after Consultant has commenced any Work, mobilization or other off-site activities under this Contract, Consultant will be paid its actually incurred costs, including administrative and general overhead costs and demobilization costs, determined in accordance with generally accepted accounting principles consistently applied, plus an amount equal to ten percent (10%) of those costs to account for profit; provided that, if compensation under this Contract is on a time and materials basis, Consultant will be compensated at the rates and profit level specified in the Contract for Work actually accomplished prior to the notice of termination. Notwithstanding the above, Company shall not pay for time and/or costs which are excessive, given the total Work actually completed prior to notice of termination.

X. FORCE MAJEURE

- 10.1 Excuse of Performance Notwithstanding anything in this Contract to the contrary, neither party shall be liable nor responsible for failure to carry out any of its obligations under this Contract caused by Force Majeure. A party rendered unable to fulfill any obligation under this Contract by reason of Force Majeure shall make reasonable efforts to remove such inability in the shortest possible time, and the other party shall be excused from performance of its obligations until the party relying on Force Majeure shall again be in full compliance with its obligations under this Contract.
- 10.2 <u>Definition</u> The term "Force Majeure" as used herein shall mean any cause beyond the control of the party affected, and which by reasonable efforts the party affected is unable to

overcome, including without limitation the following: acts of God; fire, flood, landslide, lightning, earthquake, hurricane, tornado, storm, freeze, volcanic eruption or drought; blight, famine, epidemic or quarantine; act or failure to act of the other party; theft; casualty; war; invasion; civil disturbance; explosion; acts of public enemies; or sabotage.

XI. LAWS, REGULATIONS AND PUBLIC ORDINANCES

- 11.1 <u>Compliance</u> Consultant shall comply with federal, state, and local statutes, regulations and public ordinances of any nature governing the Work, including without limitation, those statutes specifically referred to in this Article. In addition, Consultant, at its expense, shall obtain any and all licenses and permits required for the Work.
- 11.2 Taxes Consultant assumes exclusive liability for all contributions, taxes or payments required to be made because of persons hired, employed or paid by Consultant by the federal and state Unemployment Compensation Act, Social Security Acts and all amendments, and by all other current or future acts, federal or state, requiring payment by the Consultant on account of the person hired, employed, or paid by Consultant for Work performed under this Contract. Sales, use and excise taxes applicable to the value or use of any property incorporated, furnished, or otherwise supplied by Consultant shall be stated separately from the price or rates specified in Article II (COMPENSATION), and shall not be included in any computation of profit allowed by this Contract. Consultant assumes exclusive liability for all such taxes charged or chargeable upon any such goods or materials supplied by Consultant pursuant to this Contract.
- 11.3 <u>Safety and Health Regulations</u> Consultant shall comply with all federal, state and local laws and regulations pertaining to health, safety, sanitary facilities, and waste disposal. Consultant shall meet all requirements of the Occupational Safety and Health Act of 1970 (OSHA) including all amendments. Consultant shall also comply with any standards, rules, regulations and orders promulgated under OSHA and particularly with the agreement for State development and enforcement of Occupational Health and Safety Standards as authorized by Section 18 of the Act.
- 11.4 Drawings and Specifications It is the intent of Company to have all drawings and specifications for the Work comply with all applicable statutes, regulations, and ordinances. If Consultant discovers any discrepancy or conflict between the drawings and specifications and applicable legal requirements; Consultant shall immediately report the problem in writing to Company's Designated Representative.

11.5 Equal Employment Opportunity - (Applicable to all contracts of \$10,000 or more in the whole or aggregate. 41 CFR 60-1.4 and 41 CFR 60-741.5.) Consultant is aware of and is fully informed of Consultant responsibilities under Executive Order 11246 (reference to which include amendments and orders superseding in whole or in part) and shall be bound by and agrees to the provisions as contained in Section 202 of said Executive Order and the Equal Opportunity Clause as set forth in 41 CFR 60-1.4 and 41 CFR 60-741.5(a), which clauses are hereby incorporated by reference.

. . .

11.6 Employment of Disabled Veterans and Veterans of the Vietnam Era - (Applicable to all contracts of \$10,000 or more in the whole or aggregate. 41 CFR 60-250.4 and 41 CFR 60-741.5.) Consultant agrees that it is and will remain in compliance with the rules and regulations promulgated under The Vietnam Era Veterans Readjustment Assistance Act of 1974, The Affirmative Action Clause set forth in 41 CFR 60-250.4, the Rehabilitation Act of 1973 and the Equal Opportunity Clause set forth in 41 CFR 60-741.5, which clauses are incorporated by reference herein.

XII. MISCELLANEOUS

- 12.1 Patents and Copyrights Consultant agrees that in performing Work under this Contract, it will not knowingly use any process, program, design, device, or material which infringes on any United States patent or copyright or any trade secret agreement.
- 12.2 Security Consultant and Consultant's employees who perform Work under this Contract shall comply with the security practices and procedures prescribed by Company to cover any Company property where Work may be performed. Consultant shall advise its employees of these practices and procedures. Company will make a copy of these practices and procedures available to Consultant upon request.
- 12.3 Amendments This Contract may be amended or supplemented by and only by written instrument duly executed by each of the parties.
- 12.4 Severability of Provisions In the event a court or other tribunal of competent jurisdiction at any time holds that any provision of this Contract is invalid, the remainder of this Contract shall not be affected thereby and shall continue in full force and effect.

- 12.5 Entire Contract This Contract, including Attachment A, shall constitute the entire understanding between the parties, superseding any and all previous understandings, oral or written, pertaining to the subject matter contained herein. The parties have entered into this Contract in reliance upon the representations and mutual undertakings contained herein and not in reliance upon any oral or written representation or information provided to one party by any representative of the other party.
- 12.6 Applicable Law/Forum This Contract is made under and shall be governed by and construed in accordance with the laws of the State of Hawaii. Each party agrees and consents that any dispute arising out of this Contract, however defined, shall be brought in the State of Hawaii in a court of competent jurisdiction.
- 12.7 No Waiver The failure at any time of either party to enforce any of the provisions of this Contract, or to require at any time performance by the other party of any of the provisions hereof, shall in no way be construed to be a waiver of such provisions, nor in any way construed to affect the validity of this Contract or any part hereof, or the right of any party thereafter to enforce each and every such provision.
- 12.8 Access to Records Upon request, Consultant shall make available for inspection and audit by Company in Honolulu, Hawaii any and all records and/or documents relating to Work performed under this Contract during the performance of the Work and for a period of up to two (2) years from the completion of all Work under this Contract.
- 12.9 Regulatory Approvals This Contract shall be contingent upon any and all required governmental and regulatory approvals; including those of the Public Utilities Commission.
- 12.10 <u>Gender and Number</u> The terms "Company" and "Consultant," as and when used herein, or any pronouns used in place thereof, shall mean and include the masculine, feminine and neuter, the singular or plural number, individuals, partnerships, trustees or corporations and their and each of their respective successors, heirs, personal representatives, successors in trust and assigns, according to the context thereof.
 - 12.11 Attorneys' Fees and Costs Omitted.
- 12.12 <u>Survival of Obligations</u> All confidentiality obligations hereunder shall survive termination of this Contract.

XIII.COUNTERPARTS CLAUSE

HECO T-6 ATTACHMENT 5 (O) **PAGE 13 OF 17 AUGUST 2007 SUPPLEMENT**

The parties agree that this Agreement may be executed in counterparts, each of which shall be deemed an original, and all of which shall together constitute one and the same instrument binding all parties notwithstanding that all of the parties are not signatories to the same counterparts. For all purposes, duplicate unexecuted and unacknowledged pages of the counterparts may be discarded and the remaining pages assembled as one document.

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be signed by appropriate representatives of each as of the date indicated.

> HAWAIIAN ELECTRIC COMPANY, INC. ("Company")

By Ror Karl E. Stahlkopf

DATE: 8-9-07

Its Sr. Vice President, Energy Solutions and Chief Technology Officer

> UNIVERSITY OF HAWAII ("Consultant")

AUG 2 2007

DATE:

YAA-YIN FONG

Director - Office of Research Services

ATTACHMENT A

Special Conditions - Work to be Performed

Objective:

The primary objective of this consulting contract to the Hawaii Natural Energy Institute (HNEI) at the University of Hawaii at Manoa (UH) [the Consultant] is to assist the Hawaiian Electric Company (HECO) [the Company] in the evaluation, documentation, repair, maintenance and data management of all photovoltaic (PV) demonstration systems installed across the state of Hawaii at public-schools (under the "Sun Power for Schools" Program), as well as military and other sites. The "Sun Power for Schools" PV-installations on the island of Oahu include four "new" public-school systems (commissioned in 2006 at Jarrett Middle School, Highlands Intermediate School, Nanakuli High/Intermediate School, and Waianae Intermediate School), and ten "old" public-school systems (commissioned prior to 2006 at Kaimuki High, Waianae High, McKinley High, Campbell High, Waipahu High, Mililani High, Waialua High, Castle High, Kahuku High, and Kapolei Middle Schools). In addition, the Company has installed "old"-style PV demonstration systems on the outer islands of Hawaii, Maui, Molokai and Lanai, and two systems on military sites (Hickam Air Force Base, and Ford Island, both commissioned prior to 2006).

The near-term strategies of this consultation agreement with HNEI include: (1) the development and documentation of troubleshooting procedures for PV-System-operations, Data-Acquisition-System (DAS)-operations, and Data Transmission System operations for both "old" and "new" style installations; (2) the establishment of web-based data exchange in the four "new" systems; (3) the evaluation, troubleshooting and repair of the ten Oahu-based "old"-style systems; (4) the review and establishment of converting "old" style installations to web-based data exchange; and (5) the development of a proposed plan to evaluate, troubleshoot and repair all Hawaii installations, including the outer-island, military, as well as other future sites. This strategy is consistent with broader goal of fully-operational PV installations with updated and improved information-management capabilities across the state of Hawaii.

Scope:

Consultant shall complete the project entitled "Data Acquisition System Troubleshooting, Repair, Monitoring, and Maintenance of Photovoltaic Systems" described herein. Company will specify which DAS are to be worked on, provide available information on DAS and photovoltaic system, and assist in the coordination of access to the photovoltaic installations. Consultant will advise Company and the State of Hawaii Department of Education (DOEd) on the source of the problem, provide recommendations for repairing or maintaining DAS, and procure necessary equipment. Consultant shall procure minor DAS repair parts and equipment and proceed with labor to repair/maintain DAS only upon receiving approval by the Company and DOEd (owner of PV systems). If deemed necessary by Company, Consultant shall incur travel expenses (for example, in the evaluation and repair of neighbor island photovoltaic installations), with all travel arrangements contingent upon Company approval.

HECO T-6 ATTACHMENT 5 (O) PAGE 15 OF 17 AUGUST 2007 SUPPLEMENT

Assignments:

In accordance with the stated project scope, the consulting work for the Company under this agreement will be performed by the Consultant's team of Senior and Student Engineers. Company will define specific assignments for Consultant to perform involving the Activities and Tasks described below ("Assignments"). On a quarterly basis, Consultant will submit to Company an Assignment status report in conjunction with a quarterly invoice.

Activity 1: Development and Documentation of Troubleshooting Procedures for PV-, DAS-, and Data Transmission- Systems:

In this work McKinley High School and Jarrett Intermediate School will be used as representative cases of functional "old" and "new" installations, respectively. The Consultant with work with Company, McKinley High- and Jarrett Intermediate- representatives in scheduling installation site visits necessary for the system evaluation activities. Based on these cases studies, comprehensive documentation of generalized troubleshooting procedures will be generated, covering operations of the PV systems, the DAQ systems, and the data management systems in both "old" and "new" style installations.

Activity 2: Validation of System Operations in "New" Oahu School Installations:

In this focus activity, system operations of the "new" PV-installations at Jarrett Middle School, Highlands Intermediate School, Nanakuli High/Intermediate School, and Waianae Intermediate School (listed in order of priority) will be evaluated and validated. The goal will be establishing fully operational condition at these four facilities with web-based access to all system data and information. Consultant will work with Company, as well as Jarrett Middle School, Highlands Intermediate School, Nanakuli High/Intermediate School and Kaimuki High School representatives in scheduling installation site visits necessary for the evaluation and validation work.

Activity 3: Evaluation, Repair and Upgrade of "Old" Oahu School Installations:

This focus activity will entail the evaluation, repair and upgrade all the "old" PV-installations at Kahuku High, Castle High, Waialua High, Mililani High, Waipahu High, Campbell High, McKinley High, Waianae High, and Kaimuki High School (listed in order of priority). The goal will be establishing fully operational condition at these nine facilities with dial-up-based access to all system data and information. Consultant will evaluate a given installation upon Company request, and propose a repair and upgrade plan for Company approval prior to any repair and/or upgrade work. Consultant will work with Company, as well as Waianae High, McKinley High, Campbell High, Waipahu High, Mililani High, Waialua High, Castle High, Kahuku High, and Kaimuki High School representatives in scheduling installation site visits necessary for the evaluation, repair and upgrade work.

Activity 4. Evaluation, Repair and Upgrade of other Installations:

This focus activity will entail the evaluation, repair and upgrade all the other PV-Installations, including outer island sites (on Hawaii, Maui, Molokai and Lanai), military sites (at Hickam Air Force Base and Ford Island), as well as other future sites. The goal will be establishing fully

operational condition at these ten facilities with either web- or dial-up-based access to all system data and information. Consultant will evaluate a given installation upon Company request, and propose a repair and upgrade plan for Company approval prior to any repair and/or upgrade work. Consultant will work with Company, as well as representatives at the other sites in scheduling installation site visits necessary for the evaluation, repair and upgrade work.

Task Descriptions:

The consultation work in each of the four focus "Activities" will comprise Consultant's performance of specific common tasks, requiring coordination between Company and Consultant, as detailed below:

<u>Task 1:</u> Consultant will troubleshoot, repair, monitor, and maintain the Data Acquisition Systems ("DAS") of photovoltaic systems on Oahu, Big Island, Maui, Molokai, and Lanai for which the Company is or has been involved with. These include existing and future photovoltaic systems at public schools under the Sun Power for Schools program, military installations, and other sites.

Under proper data storage at each photovoltaic installation, parameters of interest include, but are not limited to:

- Year
- Julian Day
- Time of day (0100-2400)
- Voltage output of PV modules (volts DC)
- Current output of PV modules (amperes DC)
- Power output from PV modules (watts DC)
- Module temperature (degrees Celsius)
- Voltage output of inverter (volts AC)
- Current output of inverter (amperes AC)
- Power output from inverter (watts AC)
- Wind speed (meters per second)
- Ambient air temperature (degrees Celsius)
- Plane of Array solar irradiance (watts per square meter)
- Battery Voltage

Where applicable, data should be sampled every two seconds, averaged over a fifteen minute period, logged every fifteen minutes, stored on-site (datalogger memory or external memory) with enough - storage to allow approximately 1 to 3 months of storage, and downloaded from remote locations. (Note: Parameters and specifications can be modified upon agreement of Consultant and Company).

Components of the DAS as well as the sensors used to collect data and interface with the DAS are included in the Work.

<u>Task 2:</u> Consultant will troubleshoot and maintain the interface between the DAS and available analog telephone line to ensure proper communication for remote downloading of data. Other

remote communication systems (e.g., cellular phone, use of digital telephone systems, etc.) are also used or should be considered as possible solutions.

<u>Task 3:</u> Consultant will troubleshoot the interface between the DAS and local area network ("LAN") systems at certain photovoltaic installations. Consultant will work with information technology personnel at the site to ensure proper data monitoring capabilities over the site's LAN.

<u>Task 4:</u> At Company's request, Consultant may be requested to assist in the installation of DAS at new photovoltaic installations, including the interface with analog and digital telephone systems and LAN systems.

<u>Task 5:</u> At Company's request, Consultant may be requested to assist in the analysis of collected data for the purposes of evaluating and documenting the performance of photovoltaic systems.

Deliverables:

The Consultant deliverables to Company will comprise findings of troubleshooting site visits, recommendations for follow-up work, based on results from specific installation evaluations, and system repair work. Consultant will provide regular quarterly reports including updated progress in each pending Assignment, and containing estimated percentages of the tasks completed in each of the four primary Activities for the quarter. Company will evaluate each report, consider the recommendations, and establish an updated priority list for Consultant's following assignments on specific PV sites. Deliverable-based payments will be made by Company to Consultant based on services performed during the period covered by each quarterly progress report submitted by Consultant to Company, and calculated based on the reported task-completion percentages for the four primary Activities. Values for full-completion of the four Activities are assigned by Company as follows:

Activity 1: \$2,500 for full completion
 Activity 2: \$12,000 for full completion
 Activity 3: \$12,000 for full completion

4. Activity 4: \$3,500 for full completion

Payment Schedule:

Consultant shall submit quarterly invoices, not to exceed \$10,000 per quarter, to Company along with an progress report covering the status of all pending Assignments, and containing a justification of the invoice amount based estimated percentages of the tasks completed in each of the four primary Activities for the quarter pro-rated against the assigned full-completion values for each of the Activities Payment of the invoice by Company will be contingent upon Company's acceptance of the accompanying progress report.

The quarterly invoices and progress reports will be submitted by Consultant to Company within 60 (sixty) days after the end of each quarter in a given calendar year (e.g., quarter ending March 31, June 30, September 30, and December 31).

CA-101 Docket No. 2006-0386 Schedule C-8

Witness: M. Brosch

HAWAIIAN ELECTRIC COMPANY, INC. DOCKET NO. 2008-0386 PRODUCTION DEPARTMENT RESEARCH & DEVELOPMENT FOR THE FORECAST 2007 TEST YEAR

LINE NO.	DESCRIPTION	REFERENCE	AMOUNT	ADJUSTMENT AMOUNT
	(A)	(B)	(C)	(D)
1	Production Department Research Services Funding Proposed by HECO:			
2	Local EPRI Matching Funds Renawable Energy Recurring Funda	CA-829, page 1	\$ 249,000 -65,000	
4 5 6	Renewable Energy Initiative Biofuels Initiatives Electronic Shock Absorber ESA	:	300,000 100,000 221,000	
. 7	Sun Power for Schools	. 4	40,000	
8	Total Test Year Production R&D Contractor Funding Proposed by HECO	Sum Lines 27	~-075,000 ~	935,000
9	CA Adjustment to Eliminate ESA Funding - Unit Destroyed by Earthquake	Line 6	(221,000)	(221,000)
10	Production R&D Contractor Funding - Net of ESA Funding	Line 8 - Line 9	_ 754,000 -	714,000 .238,000
11	One Third of Non-ESA Funding for Months of January - April 2007	Line 10 / 3	- 251,838 -	23800
12	Actual Production R&D Contractor Funding - January through April 2007	CA-IR-245, Atl2	30,656	A), -(A)
13	CA Adjustment to Reflect Spending Deferrals/Delays	Line 12 - Line 11	(20/34	1) (20 344)
14	CA Adjustment to Normalize Production R&D Expenses	Line 9 + Line 13		\$ 14103A4)
15	CA Adjustment to Normalize Production R&D Expenses (Rounded 000's)			5 (410) 5 mm

RESEARCH & DEVELOPMENT (R&D) – NON-EPRI EXPENSES (Including Development and Demonstration of New Technology

HECO's updated test year estimate of Non-EPRI R&D expenses in the miscellaneous A&G account was \$1,156,000. This estimate included anticipated R&D costs for the Electrical System Analysis project, the AMI project, the CPP/PTR project, and the LCR project of \$496,000, \$516,000, \$60,000 and \$60,000, respectively, for a total of \$1,132,000. (The Electrical System Analysis project is discussed in Mr. Bruce Tamashiro's testimony (T-13) and in the Company's responses to CA-IR-452, 453, and 454. The AMI project is also discussed in Mr. Tamashiro's testimony and in the Company's responses to CA-IR-182, 452, 456 and 471. The CPP/PTR study and the LCR study are described in the responses to CA-IR-182, 459 and 460.) Miscellaneous project costs were anticipated at the remaining \$24,000 amount.

The Consumer Advocate and DOD have noted the annual fluctuations of the Company's expenditures in the area of R&D over the past three years. As a result, both parties proposed to "normalize" the amount of R&D expenses (charged to miscellaneous A&G) based on a three-year average, including HECO's updated 2007 forecast. The normalization resulted in \$781,000 of R&D expenses, which was \$375,000 less than HECO's updated test year estimate. In order to address this proposal, the Company reviewed the status of its individual R&D projects and related anticipated expenses for the test year which is provided below.

Electrical System Analysis

Negotiations with its vendor, General Electric ("GE"), are still underway. A statement of work has recently been received from GE (see HECO T-13, Attachment 1(A), dated July 30, 2007, which contains confidential information and is provided pursuant to Amended Protective

Order No. 23378) and is currently being reviewed by HECO and MECO engineers. Work activity is now planned to be conducted in phases with tollgate decision points. Thus, the original \$496,000 study budget estimate is also segmented to align with these phases.

Phase 1 of this project is anticipated to begin in 2007 and extend into early 2008. Tasks that are planned to be completed within this phase include: Task 1--Data evaluation, completion and manipulation; Task 2--System Model Development; and Task 3--Baseline model validation. A large amount of time and effort will be placed in completing Tasks 1 and 2 in 2007, which represent approximately 66% of Phase 1, with the balance of Phase 1 to be conducted in 2008. Based on recent communications with GE, Phase 1 costs are anticipated to be approximately \$248,000. Since approximately two-thirds of Phase 1 will be completed in 2007, HECO reduced the updated estimate of \$496,000 for 2007 by \$332,000 to \$164,000 (66% of \$248,000).

AMI

As noted in the Company's response to CA-IR-456, preliminary discussions were held with MDMS vendors/contractors to determine the feasibility of pursuing a small scale MDMS pilot project. Based on these discussions, one of HECO's vendors submitted a proposal (see HECO T-13, Attachment 1(B), which contains confidential information and is provided pursuant to Amended Protective Order No. 23378) that has been reviewed by the Company. The proposed scope of work includes the establishment/validation of project direction and framework, presentation of seminars on AMI/MDMS at the Company, development of MDMS requirements and selection of vendor, and development of detailed requirements and design. The Company anticipates that the vendor's work will begin in 2007. Based on the vendor's proposal and billings for work that has already been completed in 2007, the AMI project is

anticipated to cost \$404,000 in 2007, a decrease of \$148,000 from what had been anticipated in the Company's June 2007 Update. This includes \$108,000 that has been paid to date, an additional \$125,000 that will be billed shortly by Sensus Metering Systems for the Tower Gateway Basestations that were already deployed, and the remaining amount expected to be expended in 2007.

Critical Peak Pricing ("CPP/PTR")

As noted in the response to CA-IR-460, the CPP/PTR R&D project began in 2007 and is estimated to cost \$60,000. So far, the Company has received billings of \$34,000 from the Brattle Group for its work effort. However, it is anticipated that another \$26,000 will be billed within the next few months, making the project total \$60,000. Thus, there is no change to the CPP/PTR estimate.

Load Control Receiver ("LCR")

In its response to CA-IR-460, the Company noted that the objectives for developing the FlexNet prototype LCR are to examine the technical feasibility of such a device for use in HECO's load management programs and to initiate the introduction into the market of energy saving/demand response-enabling technologies that are capable of two-way communications through the FlexNet system. At the time that the response was prepared, the vendor of the FlexNet system (Sensus) and the vendor of the LCR (Canon) were in the process of negotiating the exchange of information that would permit the development of the prototype to proceed. Since that time, Sensus and Canon have agreed on the exchange of information, which will allow the project to move forward. The Company still anticipates that work will begin on the FlexNet

prototype LCR in 2007 and continues to include the R&D expense of \$60,000 for this activity in 2007.

Development of Environmental Strategy for Sourcing Biofuel Feedstock

As noted in the response to CA-IR-453, HECO has undertaken other additional R&D projects in the current year that were not included in the 2007 estimates, such as the project to Develop an Environmental Strategy for Sourcing Biofuel Feedstock. The work on this project will be completed by year end 2007. Of the \$92,000 contracted for the study, \$57,000 has been recorded to date with the remainder anticipated to be paid by the end of the year. Thus, HECO included \$92,000 for this project in its 2007 expenses.

Grid Code Review

Also noted in the response to CA-IR-453 was the Grid Code Review, which was not included in the original 2007 test year estimate. The vendor is currently reviewing grid code and performance standard information. The study will be completed in 2007 and the entire \$26,000 contracted amount will be recorded in 2007. At the end of July, HECO received a billing of approximately \$11,000 (see Attachment HECO T-13, Attachment 1(C)) from the vendor, which is now being processed for payment. HECO included \$26,000 for this study in its 2007 R&D expense estimate.

Biofuels Crop Studies

The Company is reviewing two proposals submitted by the University of Hawaii for these studies. The first proposal, titled "Field Evaluation of Oil Seed Crops at Benchmark Locations", is for an eighteen month study, beginning this year (see HECO T-13, Attachment 1(D)). The cost for this study is estimated at \$50,000. The project's objectives are

HECO T-13 ATTACHMENT 1 PAGE 5 OF 6 AUGUST 2007 SUPPLEMENT

to generate oil palm and kukui seedstock for research and commercial use and to establish field trials of oil palm and kukui in different environmental and climatic conditions. The second proposal, titled "Stage 1: Developing Crop Infrastructure to Support Biodiesel Refinery Operations in Hawaii" (see Attachment HECO T-13, ATTACHMENT 1(E)), reflects a study duration period of two years, with \$25,000 requested in 2007 (not including overhead expenses). The purpose of the study is to identify which hybrid of the *Elaeis* species is the most productive in the Hawaiian environment, what climatic, environmental and biological impacts might be expected, and whether productivity will sustain those farms willing to grow it.

HECO is working with the Hawaiian Agriculture Research Center ("HARC"). HARC is interested in this study and will oversee the work efforts of the University of Hawaii and University of Hawaii – Hilo. An updated proposal will be drafted with the University of Hawaii's participation. HECO is also working with EPRI on a co-funding this research. EPRI will provide cost-matching of \$50,000, so with HECO's participation, the total research projects costs for this effort will be \$100,000. A statement of work is currently being finalized with HART and, when completed, will be appended to the co-funding agreement with EPRI. As with other EPRI co-funded projects, at this point, a funding agreement will be signed and EPRI will invoice HECO for \$50,000. HECO will then make payment to EPRI. HECO will provide the Consumer Advocate with a copy of the check and funding agreement no later than September 30, 2007.

HECO T-13 ATTACHMENT 1 PAGE 6 OF 6 AUGUST 2007 SUPPLEMENT

Summary

Based on the status of the R&D projects noted above, the R&D costs for the test year are estimated as follows:

R&D Project Status:

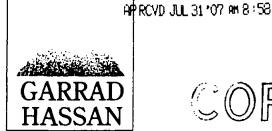
R&D Project	Anticipated 2007 Expenses
Electrical System Analysis	\$164,000
AMI	\$404,000
CPP/PTR	\$60,000
LCR	\$60,000
Biofuel Feedstock	\$92,000
Grid Code Review	\$26,000
Biofuel Crop Study	\$50,000
TOTAL	\$856,000

HECO commits to spend at least the amount of EPRI dues, i.e., \$1,608,000, plus the non-EPRI R&D amount of \$856,000 on a recurring annual basis.

HECO T-13 ATTACHMENTS 1(A) & 1(B) AUGUST 2007 SUPPLEMENT

Attachments 1(A) and 1(B) contain confidential information and are being provided subject to Amended Protective Order No. 23378, dated June 4, 2007.

HECO T-13 ATTACHMENT 1 (C) PAGE 1 OF 1 **AUGUST 2007 SUPPLEMENT**



Hawailan Electric Company (HECO)

Attn: 'Accounts Payable

P.O. Box 2750

Honolulu, Hawaii 96840-0001

WORK AUTHORIZATION NO. PNR-07-004-01-01-01

Involce No:

7400

Date:

July 27, 2007

Payment Terms:

Net 30

GH Job No: 40158 - HECO/Study of Island Utility Wind Integration

Total

Professional Services through July 1, 2007

Special Services

\$11,027.50

Total Invoice:

\$11,027.50

Please make check payable

Garrad Hassan America, Inc.

11770 Bernardo Plaza Court, Suite 209

San Diego, CA 92128

Or Wire to:

Acct name:

Garrad Hassan America, Inc.

(Note: wire fees are the

sole responsibility of the

client.)

Bank:

Citibank, N.A.

Rancho Bernardo

11818 Bernardo Plaza Court

San Diego, CA 92128

Account No:

201528809

ABA#

322271724

TPIN

94-3402236

Garrad Hassan America, Inc.

11770 Bernardo Plaza Court, Suite 209, San Diego, CA 92128 Tel: 1-858-451-7013 Fax: 1-858-451-1570

HECO T-13 ATTACHMENT 1 (D) PAGE 1 OF 4 AUGUST 2007 SUPPLEMENT

Field Evaluation of Oil Seed Crops At Benchmark Locations

Principal Investigator:

Dr. Goro Uehara

Professor

Department of Tropical Plant and Soil Sciences

College of Tropical Agriculture and Human Resources

University of Hawaii at Manoa

Tel: 808-956-6593 Fax: 808-956-3894

Email: goro@hawaii.edu

Co-Principal Investigator: Dr. Bruce Matthews

Professor

College of Agriculture, Forestry, and Natural Resource

Management

University of Hawaii at Hilo

Tel: 808-933-0853 Fax: 808-974-7674

Email: bmathews@hawaii.edu

Proposal Date:

August 1, 2007

Submitted to:

Arthur Seki

HECO

Project Start Date:

August 16, 2007

Project Duration:

August 16, 2007-December 31, 2008

Funds Requested:

\$50,007

INTRODUCTION

Local production of seed oil for conversion into biodiesel will stimulate economic development, improve air quality, and increase Hawaii's energy security. Seed oil can be obtained from a vast array of crops. Unfortunately, there has not been any commercial production or even significant research on any of the most promising oil crops in Hawaii. This six month project will take the initial steps essential to evaluate three oil seed crops: oil palm, Jatropha curcas, and kukui, and determine their potential as biodiesel feedstocks. Specifically, the project will collect germplasm, establish nurseries, prepare the land, and install the selected oil seed crops at five benchmark locations. Additional funding will be sought to generate and analyze production data and determine economic feasibility. Production of biodiesel from locally grown crops to meet Hawaii's power and transportation needs will provide economic, environmental, and energy security benefits.

OBJECTIVES

This project will be part of a long term effort by the University of Hawaii's College of Tropical Agriculture and Human Resources (UH CTAHR) to conduct research in areas central to agriculture, the environment, and society to enhance Hawaii's energy security. This project's objectives are to:

- 1. Generate oil palm, *Jatropha curcas*, and kukui seedstock for research and commercial use.
- 2. Establish field trials of oil palm, *Jatropha curcas*, and kukui in different environmental and climatic conditions.

SCOPE OF WORK

Hawaii contains a vast array of environmental and climatic conditions that range from arid sea level lands to tropical rainforests; and temperate, high elevation areas to hot, low elevation lava lands. Maximizing the profitability of any crop requires matching the crop to the agro-environmental conditions and optimizing production practices. Oil palm, *Jatropha curcas*, and kukui were selected for their potential as oil feedstocks due to their reported oil yields in other countries (oil palm, *Jatropha*) and in Hawaii (kukui). This project's scope includes the following activities: 1) preparing experimental field plots; 2) collecting oil seed crop germplasm and establishing nurseries; and 3) establishing field trials of oil seed crops at five benchmark locations.

Activity 1. Preparing experimental field plots.

Five benchmark locations will be utilized to evaluate oil palm, *Jatropha*, and kuki production potential. The benchmark sites consist of: 1) a warm, dry environment in Kohala; 2) a warm, wet environment in Lower Hamakua; 3) a cool, wet environment in Mealani; 4) a cool, dry environment in Lalamilo, and 5) a site on Aa (lava) land in Waiakea. These sites require land preparation before any planting can be done. It is expected that each trial will comprise two acres for each of the three crops at each of the

HECO T-13 ATTACHMENT 1 (D) PAGE 3 OF 4 AUGUST 2007 SUPPLEMENT

five locations. CTAHR will hire staff on a part-time basis to prepare the land, and install, maintain, and monitor field trials.

Activity 2. Collecting oil seed crop germplasm and establishing nurseries. The general lack of quality seed stock for oil crops is a challenge for research and even the smallest commercial scale operation in Hawaii. Project funds will be utilized to collect germplasm and establish nurseries for oil palm, Jatropha, and kukui for research and commercial use.

Activity 3. Establishing field trials of oil seed crops at five benchmark locations. The seedstock generated in Activity 2 will be used to establish field trials at the five benchmark locations. Additional funding will be requested for 2008 to determine growth, yield, nutrient, and water requirements for each crop at the different test sites. Funding will also be sought to use the data generated by the above study to model crop productivity across the state and determine their economic feasibility.

Key Personnel

This project will be conducted by UH CTAHR researchers and Dr. Bruce Matthews from the University of Hawaii at Hilo (UHH).

Drs. Goro Uehara will be responsible for overseeing all project activities. Dr. Matthews will be responsible for all oil palm-related activities.

Timeline

Project Activities	Start	End
Preparing experimental field plots	Month 1	Month 3
Collecting oil seed crop germplasm and establishing nurseries	Month 1	Month 6
Establishing field trials at five benchmark locations	Month 3	Month 6

Project Outcomes

The project will take the initial steps in evaluating the potential of oil palm, *Jatropha curcas*, and kukui as biodiesel feedstocks in Hawaii. Important project accomplishments include the establishment of nurseries for oil palm, *Jatropha curcas*, and kukui, and field trials in five benchmark locations.

Budget 2007- 2008					
			Total		
Personnel					
i. Field technician	\$22,700	8,252	\$30,952		
Materials and Supplies					
i. Nursery supplies			\$2,000		
ii. Field trial supplies	_		\$1,200		
Inter-island Travel					
Air fare	\$200	6	\$1,200		
Rental car	\$50	6	\$300		
Per diem	\$80	6	\$480		
Direct costs			\$36,132		
Indirect Costs (38.4%)			\$13,875		
Total Costs			\$50,007		

Budget Narrative

Personnel

A Field Technician will be hired to prepare the land for field trials, collect germplasm, establish nurseries, and install and monitor field trials. \$30,952 is budgeted for approximately half-time salary (\$22,700) and fringe benefits (36.35%).

Materials and Supplies

\$2,000 is budgeted for nursery supplies and \$1,200 is budgeted for field trial supplies.

Inter-island Travel

Inter-island travel will be required between Oahu and Hawaii Island for project participants. Six trips are budgeted for the project period.

Indirect Costs

The negotiated indirect cost rate for the University of Hawaii is 38.4%.

HECO T-13
ATTACHMENT 1 (E)
PAGE 1 OF 7
AUGUST 2007 SUPPLEMENT
A PHASED APPROACH TO DEVELOPING A BIOFUEL INDUSTRY IN HAWAI'I

STAGE 1: DEVELOPING CROP INFRASTRUCTURE TO SUPPORT BIODIESEL REFINERY OPERATONS IN HAWAII

A Proposed Venture of the University of Hawaii at Hilo

AUGUST 2, 2007

Principal Investigator:

Dr. William W.M. Steiner, Dean College of Agriculture, Forestry Natural Resource Management University of Hawaii-Hilo

HECO T-13 ATTACHMENT 1 (E) PAGE 2 OF 7 AUGUST 2007 SUPPLEMENT

STAGE 1: DEVELOPING CROP INFRASTRUCTURE TO SUPPORT BIODIESEL REFINERY OPERATONS IN HAWAII

SUMMARY

This is a phased proposal to begin 2 years of work to establish the crop infrastructure necessary to conduct oil crop research in order to begin a biofuel industry in Hawai'i. The hybrids of *Elaeis* species are the highest producing oil trees under cultivation around the world. Per acre they produce almost eight times what an acre of soybeans will produce. The work and research to be done in this proposal will investigate the feasibility of establishing these hybrids in Hawaii as an economically viable crop. Under a "Proof of Concept" model questions to be addressed include which hybrid is most productive in what Hawaiian environment, what climatic, environmental and biological impacts might be expected, and whether productivity will sustain those farms willing to grow it.

INTRODUCTION

The Issue in Hawaii

Recent rise in the cost of petroleum products has created a large potential problem for Hawaii. If the flow of petroleum is cut off, the state will suffer a drastic economic collapse since 90%+ of its energy is imported. Hawaii is moving rapidly toward resolving its fuel problem by providing legislation that enables the building of a new alternative fuels future. Current examples include legislation in 2006 and 2007 at the State and County levels that call for higher use of alternative fuels from resources within the state. These calls have led to Hawaiian Electric Company (HECO) plans to build a plant on Oahu that burns biofuel exclusively.

Given the current electrical infrastructure, biological resources show the most promise. These resources include plants such as oil palm, soy, castor bean, coconut, *Jatropha curcas* and even kukui nut oil (e.g. Table 1) and eventually algae. Recently, plans to invest in new renewable oil refineries in the State have been unveiled by refiners such as Imperium of Seattle, U.S. Biodiesel, the Bluefield/HECO consortium and by Pacific Biodiesel on Maui. But these plans currently depend on importing biodiesel stock from Indonesia and other foreign ports of origin, and do not solve the potential problems associated with international transportation associated with petroleum such as supply line cuts. Imports from these areas also suffer the stigmata of coming from areas that raise ethical problems associated with endangered species, loss of biodiversity, and increased atmospheric CO² from tropical deforestation.

Projections for plants such as Jatropha curcas (purgative nut) and Elaeis guineensis (oil palm) suggest they would grow well in Hawaii and provide more biodiesel per acre than any other crop (Poteet 2006: see Table 1 below). But to date, there are no large tracts of renewable biofuel resources in Hawaii. Several Large Landholders on the Big Island (Landowners AlohaGreen (over 1,700 acres of Hamakua Coast forest and former sugar lands), W.H. Shipman (60,000 acres of Puna district lands), Olsen Brothers Trust (16,000 acres of Kau district lands), and Kamehameha Schools Trust (100,000 acres of Waimea and other district lands) have called for large scale studies that would allow economic feasibility studies to be done. Without these studies, landowners are reluctant to expend the funds to plant tree crops that might not prove economically viable in the long run and extremely expensive to plant in the short run. They are calling for experiments to support an aggressive research and development scenario.

Proof of Concept

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Much discussion has accompanied the call for renewable energy sources for Hawaii with little basis for choice or development of strategy. Large landowners in Hawaii are hesitant to commit private funds to establishing a new crop-based industry given the recent demise of pineapple and sugar in the state. If they do commit, they want a crop that will maximize profit. What is needed is a solid base of research effort to make correct choices regarding crop type, and economic analyses to back that choice up. For example, some 24 hybrid crosses exist between the African oil palm and the American oil palm (*Elaeis oleifera*) with different growing characteristics; how these would fit into the Hawaiian landscape and their resulting productivity remains to be determined. Although willing to contribute land to such investigations, they seek a solid Proof of Concept demonstrating that profits may be real and not pie-in-the-sky. This proposal will establish the necessary information to make wise choices.

This Proof of Concept is expected to create a whole new industry for Hawaii along with hundreds if not thousands of jobs associated with growing, harvesting, milling, processing, and the secondary jobs associated with such industries (e.g. trucking, shipping, livestock feed, compost fertilizers) that are sure to arise. Hawaii is ideal as a model to establish and study these oil crops in part because it is unique in the United States for its tropical environment, and in part because it's isolation with clear energy requirements provide parameterization.

Oceanic Institute (OI), owners of a feed and extrusion mill located for educational and research purposes on CAFNRM land, is partnering with the University of Hawaii College of Agriculture, Forestry and Natural Resource Management (CAFNRM) to provide a milling capability unique in the islands. The mill is currently in containers and awaiting erection. The University will provide student interns, its 110-acre agricultural farm, a 120- acre county test site, and expertise and knowledge for research in horticulture, aquaculture, animal sciences, fruit and nut trees, and sustainable agriculture. The University of Hawaii at Hilo provides a robust on-island opportunity to examine a series of questions associated with growing renewable fuel in Hawaii. The purpose of the UHH-OI partnership in this research venture is to extract oil from oil palm and Jatropha, determine the chemical characteristics and milling requirements of this oil, and investigate other oil crops already found in Hawaii (e.g. Alleurioides moluccana or kukui nut, macadamia nut) while establishing the baseline needed to determine economic return on these crops. Byproducts of the milling operation will be studied for its use in livestock and aquaculture feeds and organic fertilizers. It is anticipated the mill will be operating by late 2008.

OBJECTIVES OF STUDY

Questions remain on agronomic requirements, climatic and hydrologic needs, fertilization requirements, pest profiles, invasive characteristics, milling requirements and oil return from milling, and waste stream characteristics in the unique volcanic environment of Hawaii. A partnership dedicated to these investigations can make the difference on which crops to establish where in Hawaii to enable energy independence. It may very well be that no one crop plant as a fuel source will satisfy all environments available for biofuel exploitation within the state. In this case knowledge of different plant productivity in different climates/niches will be useful.

The long-term goals of this study are to establish on lands reserved by landowners, County of Hawai'i, and UHH, plantations of oil palm, Jatropha and other oil-heavy crops to study growth rates, production rates, agronomic characteristics, milling and production characteristics, disease and infection characteristics and climatic differences. From studies of these plants, recommendations can be made to land owners on developing new plantations of oil crops. On the Big Island, the size of the plantings will be replicated and be large enough to enable determination of economic return. This comes about when oil of the fruits and seeds of these

plants are converted through extrusion and pressing in the OI feed and extrusion mill to a stock vegetable oil for biodiesel, and the mill byproduct is converted to either fish or cattle feed (oil palm) or fertilizer (Jatropha) establishing proof of process and return on multiple streams of output. These studies will run concurrently over the long run with year 2 beginning the study of economic feasibility. We predict that oil production for oil palm and Jatropha, which produce over 600 gallons/acre and 300 gallons/acre respectively in Southeast Asia will far surpass any other plant in Hawaii. The goal is to seek out and establish the parameters for new biofuel agricultural crops and enable island wide economic predictions based on solid data. With this design by end of year 3 landowners will have enough data on one or more crops to reliably predict return and justify planting thousands of acres in biodiesel crops to provide a solid crop for production refineries thus reducing refinery costs and increasing their value to local communities.

EXPERIMENTAL DESIGN AND GOALS

There is a wide choice of plants for these studies. Preliminary study and estimates indicate some may be more amenable to growing in Hawaii than others (see list). Economic surveys suggest the list may be narrowed even further (see asterisks in list; those in blue are most promising). Oil palm and Jatropha must be collected from stock available only over seas in Central America or Mexico. This has begun with Jatropha curcas with 15,000 seedling trees under development at the University and 20,000 seeds of Oil Palm to be bought and planted.

TABLE 1. Potential crops for biodiesel production in Hawaii.

Ascending order							
Crop	kg oil/ha	Litres oil/ha	lbs oil/acre	US gal/acre			
Soybean	375	446	335	110			
tung oil tree*	790	940	705	100			
Sunflowers*	800	952	714	102			
cocoa (cacao)*	863	1026	771	110			
Peanuts*	890	1059	795	113			
castor beans*	1188	1413	1061	151			
Jojoba*	1528	1818	1365	194			
Macadamia nuts*	1887	2246	1685	240			
Avocado*	2217	2638	1980	282			
coconut*	2260	2689	2018	287			
Jatropha*	1590	446	1420	310			
oil palm*	5000	5950	4465	635			

Justification of Research Sites

Focusing this research on the Big Island has several advantages:

(1) It takes advantage of the island with the most varied island environments and the

HECO T-13 ATTACHMENT 1 (E) PAGE 5 OF 7 AUGUST 2007 SUPPLEMENT

- most growing land (the state of Hawaii has 1.3 million acres of developed agricultural lands with over 800,000 acres on the Big Island of Hawaii of which 140,000 lies fallow);
- (2) It is supported by the large landowners and County of the Big Island who offer land and support of research programs that might enable development of a new industry;
- (3) It has hundreds of thousands of acres of additional State land (DLNR, DHHL), mostly lava flows in nature, which might prove valuable for future plantation development for drought resistant crops like *Jatropha*;
- (4) It is proven in its ability to produce nut and palm tree crops.
- (5) CAFNRM is located there and is uniquely suited in having a core faculty able to investigate many of the questions associated with developing these crops with addition of a few additional faculty;
- (6) CAFNRM has agreements in place with Oceanic Institute to house its Feed Mill, considered a core facility to process biofuel plants to their basic components of oil (for biofuel investigation), mill stock (for animal feed development) and waste (for compost).

However, this work will not be complete without knowing how selected oil crops perform on other islands. Therefore 18 acres of oil palms will be planted on Oahu at 800 feet elevation for comparison at a dedicated North Shore site. The robustness of any economic model for strategic crop development must include some modeling effort. Partnering with the Pacific Basin Information Node (PBIN) with its access to USGS maps and other databases will provide this component.

Research Design

Plots of five selected hybrid oil palms will be established at 3 different elevations with 3 different climatic profiles with and without irrigation, on different soil characteristics for the two highest producing oil crops in Table 1. On Hawaii Island, minimal plot sizes will be 5 acres and will be replicated 3 times in a 3 X 3 factorial design at 3 elevations. On Oahu 3 hybrids will be planted on 3 acre plots in a 3 X 2 factorial design. The following characteristics as research or question sets for each plant/plot will be addressed and established:

Growth rate, flowering rate, date of first of fruit fall, amounts harvested/acre (plot), gallons/acre (OI), waste stream productivity (OI), cost of maintenance, harvest and processing (both partners). Databases will be held by PBIN for data analyses. Oil produced from these studies will be given for consideration of funding of operations on a pro-rata basis at the going price plus a premium (if any) to partner refineries whose sales will be tracked to become part of the economic model.

These questions are asked against a background associated with the plot; that is climatic variables (rainfall, days sunlight, temperature change, soil type), treatment (effect of fertilizer ratios 1, 2 and 3; effect of pesticide treatments if any), and biologicals (pests).

Beginning in year two and continuing thereafter, economic feasibility will be determined by cost comparisons against real rate of yield as seed gathered from the harvest is pressed at the Oceanic Institute mill and sold by the partner refinery. Economic analysis will include yield from the waste stream from the oil product marketed as fertilizer or compost to local organic growers.

All replications will be repeated for at least 3 years for fast growing crops (e.g. jatropha, avocado) and 6 years (dependent on leveraged funding) for slower growing crops (e.g. oil palm, kukui nut). Leveraged funding will be sought from State and Federal agencies and private foundations. Oil may be shared at premium price with other contributing refineries on a percentage contribution basis to defray expenses and pay for development of harvesting

HECO T-13 ATTACHMENT 1 (E) PAGE 6 OF 7 AUGUST 2007 SUPPLEMENT

machinery. At its peak this project will have 200 acres of palm oil and 100 acres of jatropha under cultivation producing between 150,000 and 190,000 gallons of unrefined vegetable oil.

PROPOSED BUDGET

CAFNRM has a 110 acre farm facility already established with a feed mill on site and green and shade houses for growing out seed and is negotiating a long term contract with the County of Hawai'i for a 120 tract at Paauilo dedicated to growing oil crop trees. Funds are required for short term research that would collect the necessary seed stocks, refurbish shade houses for seedling rearing, grow seedlings to a stage for replanting into field plots, develop, establish and maintain the field plots and establish the data base effort. The following funds are requested:

Phase 1, Fail 2007:	
Inter-island travel	\$ 500
Purchase of phase 1 seed stock	\$ 5,000
Funding for 2 student internships fall semester	\$ 7,500
Repair of WOL shade house	\$ 9,000
Funding to start and maintain seed (fertilizer, cups, etc)	1,000
Database efforts	\$ 2,000
Phase 1 Total	\$ 25,000
Phase 2, Spring 2008:	
Inter-island travel	\$ 500
Purchase of phase 2 seed stock	\$ 5,000
Funding for 2 student Interns	\$ 7,500
Database efforts	\$ 2,000
Purchase of shade house supplies	\$ 3,000
Begin land preparation for planting seedlings	\$ 7,000
Phase 2 Total	\$ 25,000
Total requested year 1:	\$50,000
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Phase 3, Fall 2008:	
Inter-island travel	\$ 500
Funding for 2 student interns	\$ 5.000
Continue land leveling and preparation for planting seedlings	\$ 20,000
Planting supplies, fertilizer, pesticides and labor	\$ 10,000
Phase 3 Total	\$ 35,500
Phase 4, Spring 2009:	·
Inter-island travel	\$ 500
Funding for 2 student interns	\$ 5,000
Continue land leveling/terracing for planting seedlings	\$ 20,000
Planting supplies, fertilizer, pesticides, labor	\$10,000
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Phase 4 Total	\$35,500
Phase 4 Total Total requested year 2:	<i>\$35,500</i> \$70,000

University of Hawaii overhead expenses (21.2%) = \$25,440 (yr.1 = \$10,600, yr.2 = \$14,840)

Amount leveraged:

10% salary of UHH Soil Scientist, Agricultural Economist, Horticulturalist, Environmental Scientist, Forester, Statistician, Geneticist, Mechanical Engineer, nut&fruit scientist, and greenhouse manager/year: \$110,000 Contribution of UHH Agricultural facilities (greenhouses, land,

HECO T-13 ATTACHMENT 1 (E) PAGE 7 OF 7

AUGUST 2007 SUPPLEMENT

Tractors, utilities, vehicles for transport, etc)/year: \$100,000
Contribution of accounting services 20,000
Contribution of Oceanic Institute Mill operations/year: \$60,000

Contribution of Farmers as land resources, irrigation water, etc:

120 acres@\$150/ac/year \$ 30,000 Total leveraged = 64.13% (\$320,000/499,000) \$320,000

Total Hawaii Island cost of proposed project: \$499,000

This core funding will enable other funding needs to be met by competing for federal R&D funding from the USDA, the Alternative Diesel Fuel Act of 2006, S. 3554 (Senators Lugar (D-IN), Obama (D-IL), Cochran (R-MS) and Carper (D-DE) of June 21, 2006, the U.S.-India Energy Security Cooperation Act, S. 1950, Senator Lugar (D-IN), of November 1, 2005, and other Federal and private agencies.

Budget Justifications

Travel by a representative from UHH CAFNRM to visit Central America to examine and obtain hybrid oil palm stocks purportedly capable of producing a 1000 gallons of oil/acre has been completed. Arranging shipment of seeds to Hawaii was a main purpose of this trip, enabling the very best productive oil crops for Hawaii for future production success. The USDA Permitting process is now underway but seed needs to be purchased. Inter-island travel is requested to visit test sites on Oahu and consult with HECO principles.

Student intern support adds a necessary educational component; there is a need to begin training the next generation of specialists for growing oil crops in Hawaii. Students are an inexpensive addition to the labor that will be required for growing, planting and maintaining seedlings and field crops and gathering data.

A shade nursery is required to rear seedlings of oil palm. Waters of Life (WOL) Charter School has a five-acre house in need of repair. It is willing to loan it to UHH CAFNRM in return for educational access for their K-12 students to learn about growing palm trees. Phase 1 and 2 funding is requested to do the repairs and begin growing the seedlings. Growing trees out requires 16 months from planting seeds to planting seedlings in the field.

Land preparation costs and supplies for planting and maintenance are real costs necessary prior to moving seedlings out of the nursery into the field. The fallow lands targeted for planting are former sugar cane lands now overgrown with grasses, ten year old trees, and brush and in some cases cut by erosion. Located mostly on hillsides, this land will have to be terraced for planting.

We will work with the Pacific Basin Information Node (PBIN) of the U.S. Geological Survey to develop the necessary infrastructure to handle the massive amounts of data that will be generated by this project. PBIN (see the web) will require funding for supplies for this project.

REFERENCES

Poteet, Michael D. 2006. Biodiesel Crop Implementation in Hawaii. HARC Report to the Hawaii Department of Agriculture, HARC contract # 2006-2. 86 pp.

Steiner, W.W.M. 2005. The coming paradigm shift: Sustainable agriculture, Natural Resources, and the Future. Journal of Hawaiian and Pacific Agriculture 13: 3-8.

HECO T-14 ATTACHMENT 2 PAGE 1 OF 23 AUGUST 2007 SUPPLEMENT

LABOR EXPENSE ADJUSTMENTS

The following are the reasons and supporting documentation for the Company's adjustment to the number of employees reflected in Schedule C-16 and C-17's "Actual" column for Responsibility Areas ("RA") PFB, PNI and PSP.

RA "Actual" Employee Count Adjustment Documentation

PFB For RA PFB, Compensation & Benefits, an Agency Temporary hire was utilized from September 2006 through April 2007 to assist in fufilling the work requirements of the department including those that would normally have been assigned to the two vacant positions. The total 2006 and 2007 costs for the Agency Temporary hire were \$10,920 and \$12,486, respectively (see HECO T-14, Attachment 2, pages 3 and 4). These costs were unbudgeted as reflected in the supporting documentation.

Although the Agency Temporary hire was only utilized by the department for four months of the year, an Employee Benefits Administrator was hired on July 19, 2007 (see Company's response to CA-IR-465, for month ending June 30, 2007, under "JVR Received" column). Also, the Benefits Analyst position that was vacant on June 30, 2007 (see Company's response to CA-IR-465) will be filled by a permanent employee, effective August 28, 2007. Because the department incurred unbudgeted nonlabor costs for an Agency Temporary hire and has filled two of its vacant positions since July, the reflection of the "average" employee count of nine is conservative. By increasing the "Actual" number of employees by one (for a total of "9"), the reduction of the Consumer Advocate's "Adjustment Percentage Difference" from -10% to -5% in both the HECO T-14, Attachments 1(C) and 1(D) is appropriate.

PNI Although the employee count for RA PNI was "2" on December 30, 2006, a HECO Temporary hire began employment on January 16, 2007 to fulfill the duties of the Government Relations Director position. This person's employment ended on May 5, 2007 (see HECO T-14, Attachment 2, pages 5 and 6. NOTE: Pages 5 through 16 reflect information that is confidential and are provided pursuant to Amended Protective Order

HECO T-14 ATTACHMENT 2 PAGE 2 OF 23 AUGUST 2007 SUPPLEMENT

No. 23378) which accounts for the employee count of "2" on June 30, 2007, as reflected in the Company's response to CA-IR-465. The costs for the Temporary Hire were unbudgeted and amounted to \$12,762 for this four month period (see HECO T-14, Attachment 2, pages 7 through 15).

The Company has since hired a permanent employee for the Government Relations Director position who started on August 1, 2007 (see HECO T-14, Attachment 2, page 16) which raises the actual employee count to "3". In effect, the Government Relations Director's position will be filled for at least nine months of 2007 -- four months by the HECO Temporary hire and the remaining five months of 2007 by a permanent employee. Thus, the number of employees in the "Actual" column should be raised to "3" which would then appropriately reduce the Consumer Advocate's labor budget adjustment to "0".

PSP In the HECO response to CA-IR-127, part c., the Company notes that the services of a contract hire were used to "make up for the vacant Pricing Analyst position". The services of the contract hire cost approximately \$20,300 for a period of approximately three months in 2007 (see HECO T-14, Attachment 2, page 21), close to the \$24,000 that is being proposed as a labor reduction by the Consumer Advocate for an employee for half of the year. Costs incurred for the contract hire were unbudgeted as noted by the absence of costs for "Temp Hire" on the "EE 503" row of the "Contract Services" section of the test year budget (see HECO T-14, Attachment 2, page 19), provided in the Company's response to CA-IR-2, HECO T-10).

Although the contract hire left the temporary position in April, the Company has been actively recruiting for this position throughout the year and a qualified candidate has recently (8/24/07) accepted the position. Thus with the filling of this position, the Company will incur nearly its entire test year budget for the temporary hire and the employee and an increase of the number of employees to "5" in the "Actual" column appropriately eliminates the labor adjustment proposed by the Consumer Advocate.

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Program Description

General Ledger Balances Review [HAWAIIAN ELECTRIC COMPANY, INC.]

Version Revision

Module

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Product Version File Version

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Confidential Information
Deleted Pursuant To
Amended Protective Order No. 23378

HECO T-14 ATTACHMENT 2 PAGES 5-16 OF 23 AUGUST 2007 SUPPLEMENT

Pages 5-16 contain confidential information and are being provided subject to

Amended Protective Order No. 23378, dated June 4, 2007.

HECO T-14 ATTACHMENT 2 PAGE 17 OF 23 AUGUST 2007 SUPPLEMENT

> CA-IR-2 DOCKET NO. 2006-0386 HECO T-10 ATTACHMENT 6 PAGE 1 OF 4

HAWAIIAN ELECTRIC COMPANY 2007 TEST YEAR RATE CASE

ENERGY SERVICES DEPARTMENT NONPROJECT COST DATA

NARUC 921: ADMIN & GENL EXP - NONLABOR

RA-PSP

HECO T-14 ATTACHMENT 2 PAGE 18 OF 23 AUGUST 2007 SUPPLEMENT

> CA-IR-2 DOCKET NO. 2006-0386 HECO T-10 ATTACHMENT 6 PAGE 2 OF 4

PRICING DIVISION

2007-2008 Budget Assumptions NonLabor

Same \$ Each Year

1 Out of State Training	PSP 738 PHE NE NPSZZZZZ	CS000093	\$2,000
2 In-State Training	PSP 736 PHE NE NPSZZZZZ	CS000110	@\$1,000
3 Subscriptions	PSP 736 PHE NE NPSZZZZZ LOI	CS000093	- \$250
4 Stationery & Supplies	PSP 736 PHE NE NPSZZZZZ	CS000114	- \$2,000X
5 PCOM Maintenance	PSP 736 PHE NE NPSZZZZZ-501	CS000093	@\$6,000
8 PC SAS Maintenance	PSP 738 PHE NE NPSZZZZZ-501	CS000093	Ø\$2,500/Q
7 PCEA	PSP 102 PHE NE NPSZZZZZ-522	CS000093	-\$2,700
8 Consultant	PSP 738 PHE NE C0000595-501		B \$50.000 /

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Total

160-7,500 63,790 B=9,000

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HECO T-14 ATTACHMENT 2 PAGE 19 OF 23 AUGUST 2007 SUPPLEMENT

> CA-IR-2 DOCKET NO. 2006-0386 HECO T-10 ATTACHMENT 6 PAGE 3 OF 4

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2007-2008 SP Division (REFLECTS DIRECT CHARGES ONLY — EXCLUDES OVERHEADS)

(VARIOUS ACTIVITIES) COST TYPE	2004	2005	2008	2007	2008
<u>COST TIPE</u>	2004			1007	
LABOR (productive labor)	136,163	137,743	194,941	248,077	260,239
OVERHEADS	***	144	***	***	***
NON-LABOR					
MATERIALS					
(201) (205) Mattl Purchase	2,150	2,150	2,250	2,250	2,250
(232) Stat & Supp-Iss		***	_		
(640) Post & Bulk Mail***	-	-	-		-
TRANSPORTATION					
(301) Pool Vehicles	***	-			-
ISD SERVICES"					
(462) IS Expenses - SFTW	-	•••	-		-
CONTRACT SERVICES					
(601) O/S Svc -Gen	33,250	61,750	59,500	59,500	59,500
(501) O/9 Svc -Design Works	35,000			-	
(503) Temp Hire	47,928	48,132			
(520) Mainland Travel		10,000	2,000	2,008	2,000
(521) Meats & Entertainment		-	_		
(522) Interbland Travel	-	2,700	***	2,700	-
O&M Impact	254,491	262,476	258,091	312,527	323,989
DSM Programs:					
Contract hires	****	4944	0	0	0
TOTAL O&M Impact			321,841	378,977	387,739
Biliable Information (without overheads)A				
HELCO	33,740	37,612	48,513	32,441	33.634
MECO	33,740	36,937	49,587	33,723	34,984
	67,460	74,549	98,080	66,164	68,598
THER					
Prel. Eng. (Privatization Labor)	9,721	9,483	1,698	1,424	
CIS Rep. Project Labor -Deferred	18,438	26,100	15,778	3,499	
Vacation/Holiday	28,292	26,183	39,835	35,626	38,339
Total Other	56,449	61,746	51,307	40,549	38,339

^{**} Excludes ISD Charges (CT 461 and 452) Inrecested by IS Dept.

RAZPSP

Not Meaningful to conpare given change in overhead allocations in 1999.

^{***} Post & Bulk Mail forecasted by another dept. from Y2000 on.
**## DSM Program Costs (O&M/Billable) forecasted by E. Wong.

^{*} includes PRIVATIZATION labor costs forecasted by Engineering DSM Program base labor costs forecasted by E. Wong, and CIS Replacement hours forecasted by CSD.

[^] Includes Billable DSM labor forecasted by E. Wong.

HECO T-14 ATTACHMENT 2 PAGE 20 OF 23 AUGUST 2007 SUPPLEMENT

> CA-IR-2 DOCKET NO. 2006-0386 HECO T-10 ATTACHMENT 6 PAGE 4 OF 4

- b. Hardcopy supporting documentation will be sent via E-mail.
- c. The following represents Pricing Division's non labor budget items that exceed \$50,000.

NARUC RA Act. # Activity FE# Expense Element Amount
921 PSP 736 Pricing Anlys/Proposal 501 Outside Svcs-Gen. \$59,500

The \$59,500 budget represents an estimated amount for training (\$1,000), PCOM license agreement (\$6,000) and PC SAS license renewal agreement (\$2,500). In addition, \$50,000 has been budgeted to retain Pricing consultants (\$50,000). In the case of the PC SAS agreement, the budgeted amount was based on renewal of an existing license agreement while the \$50,000 budgeted amount for the Pricing consultant assumes continued usage of Pricing consultants for tariff development work.

d., e, f, and g: No other information is available.

RACPSP

HECO T-14 ATTACHMENT 2 PAGE 21 OF 23 AUGUST 2007 SUPPLEMENT

2006 - 2007 Charges for Pricing Division Temporary Hire

20	006	2	007
Involce Date	Invoice Amount	involce date	Invoice amount
11/28/2006	\$138.52	1/22/2007	\$3,287.89
12/11/2006	\$1,635.31	2/5/2007	\$3,287.89
12/26/2006	\$3,123.50	2/26/2007	\$2,959.10
		3/5/2007	\$3,287.89
total for 2006	\$4,897.33	3/19/2007	\$3,287.89
	·	4/2/2007	\$3,287.89
		4/6/2007	\$863.07
		total for 2007	\$20,261.62

Total 2006-2007 Involces paid for Pricing Division Temp Hire \$25,158.95

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6	001 12/26/2006	2 50 X 001	3123.50			
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HECO T-14
ATTACHMENT 2
PAGE 22 OF 23
AUGUST 2007 SUPPLEMENT

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HECO T-14 ATTACHMENT 2 PAGE 23 OF 23 AUGUST 2007 SUPPLEMENT

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RA-275P

LABOR EXPENSE ADJUSTMENT - RA "PHS"

The last Responsibility Areas ("RA") that the Consumer Advocate had stated that it would be willing to discuss in terms of average employee counts if provided more information is RA "PHS", the Security division. As noted in Schedules C-16 and C-17, at the end of 2006 the department experienced three vacancies which were created when three security officers left HECO employment.

In order to maintain security coverage after the departure of these three officers, the Company has used the services of temporary agency hires provided by Olsten, a temporary staffing agency, and has expanded the number of hours requested to be provided by its primary contract security services vendor, AKAL Security, Inc. ("AKAL"). By requesting an additional 80 hours per week of security services from AKAL, the Company has attempted to cover two of the vacant positions. Unfortunately, AKAL has not been able to provide security officers for the total additional time requested on a consistent basis.

However, the Company has been successful in employing a temporary agency hire who has worked continuously from the end of 2006 to present as a replacement for one of the vacant positions. Currently, there are no plans to change this arrangement. The total costs incurred for the services of this one officer from January through June of this year amounts to more than \$32,000 (see Attachment 3(A). This attachment contains confidential information and is submitted pursuant to Amended Protective Order No. 23378). The Company has also used the services of other officers as well from Olsten but on an intermittent basis due to the unavailability of qualified personnel. As noted (by its absence) in Attachment 3(B), outside temporary services, expense element code "503", was unbudgeted for security services. As a result, for settlement purposes, the Company will reflect the addition of only one employee count in the "Actual" column of Schedules C-16 and C-17, RA PHS, raising the total "Actual" employee count to "8" and the Company will reduce direct labor expenses and oncosts by \$47,650 and \$696 for Schedules C-16 and C-17.

Confidential Information
Deleted Pursuant To
Amended Protective Order No. 23378

HECO T-14 ATTACHMENT 3(A) PAGES 1-27 OF 27 AUGUST 2007 SUPPLEMENT

Attachment 3(A) contains confidential information and is being provided subject to Amended Protective Order No. 23378, dated June 4, 2007.

HECO T-14 ATTACHMENT 3(B) PAGE 1 OF 2 AUGUST 2007 SUPPLEMENT

> CA-IR-2 DOCKET NO. 2006-0386 HECO T-10 --ATTACHMENT 22 PAGE 10 OF 21

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HECO T-14 ATTACHMENT 3(B) PAGE 2 OF 2 AUGUST 2007 SUPPLEMENT

CA-IR-2 DOCKET NO. 2006-0386 HECO T-10 ATTACHMENT 22 PAGE 11 OF 21

LABOI	REXPENS	E ADJUST	MENTS FOR			
				<u></u> HS, PSP, PN	<u> </u>	
NLOF	JIAGIDICII	I ANEAS (I	1A), PED, F	ns, rsr, rn		<u> </u>
RA	Account	<u>C-16</u>	<u>C-17</u>	Direct Total	OnCost	TOTAL
PFB	920	\$1,143.00		\$1,143.00	\$131.45	\$1,274.45
	925		\$257.00	\$257.00	\$29.56	
	926000		\$21,029.00	\$21,029.00	\$2,838.92	\$23,867.92
	926010		\$4,559.00	\$4,559.00	\$615.47	
	9302		\$36.00	\$36.00	\$4.86	\$40.86
	Total	\$1,143.00	\$25,881.00	\$27,024.00	\$3,620.24	\$30,644.24
PHS	920	\$21,367.00		\$21,367.00	\$2,457.21	\$23,824.21
 	932		\$307.00	\$307.00	\$35.31	\$342.31
	Total	\$21,367.00	\$307.00	\$21,674.00	\$2,492.51	\$24,166.51
PSP	920	\$24,006.00		\$24,006.00	\$2,760.69	\$26,766.69
	320	Ψ24,000.00		Ψ24,000.00	Ψ2,700.03	Ψ20,700.03
PNI	920	\$34,312.00		\$34,312.00	\$3,945.88	\$38,257.88
TOTAL		\$80,828.00	\$26,188.00	\$107,016.00	\$12,819.32	\$119,835.32
Oncost	Cals	\$9,295.22	\$3,535.38			
Total per	r schedule	\$90,123.22	\$29,723.38			

HECO T-19 ATTACHMENT 1(a) PAGE 1 OF 1 AUGUST 2007 SUPPLEMENT

Credit Ratings

Attached are two articles from credit rating agencies regarding HECO.

- -- Standard and Poor's article (Attachment 3)
- -- Moody's article (Attachment 4)

[23-May-2007] Research Update: Hawaijan Electric Ratings Cut To 'BBB'; Outlook Stable Page 1 of 4



RESEARCH

Research Update:

Hawaiian Electric Ratings Cut To 'BBB'; Outlook Stable

Publication date:

Primary Credit Analysts:

23-May-2007

Barbara A Eiseman, New York (1) 212-438-7666; barbara_elseman@stendardandpoors.com Anne Selting, San Francisco (1) 415-371-5009; anne_selting@stendardandpoors.com

Rationale

On May 23, 2007, Standard & Poor's Ratings Services lowered its long-term corporate credit and unsecured debt ratings on Hawaiian Electric Co. Inc., Hawaiian Electric Light Co. Inc. (HELCO), and Maui Electric Co. Ltd. (MECO) to 'BBB' from 'BBB+'. Standard & Poor's affirmed its 'A-2' short-term corporate credit rating on Hawaiian Electric. The outlook is stable.

Hawaiian Electric is a subsidiary of diversified holding company Hawaiian Electric Industries Inc. (HEI) whose ratings were affirmed. Standard & Poor's also revised its outlook on HEI to stable from negative.

The downgrade of Hawaiian Electric is the result of sustained weak bondholder protection parameters compounded by the financial pressure that continuous need for regulatory relief, driven by heightened capital expenditure requirements, is creating for the next few years.

The ratings on HEI are based on the consolidated credit profile of HEI's units, which include Hawaiian Electric and its units (83% of core revenues and 65% of operating income as of Dec. 31, 2006) and the financial services operations of American Savings Bank FSB (17% of core revenues and 35% of operating income). Standard 6 Poor's does not accord any credit uplift to American Savings Bank as a result of its affiliation with HEI.

HEI's financial condition remains weak for the rating despite the healthy Hawaiian economy and the company's efforts in recent years to strengthen its capital structure. Financial metrics have been pressured owing to rising operating and maintenance expenses, increasing capital outlays, and recently, lower electricity sales caused by cooler less humid weather and customer conservation. Absent responsive rate orders in Hawaiian Electric's pending rate cases, prospective key financial metrics may not support a financial profile that is commensurate with the current ratings.

HEI and Hawaiian Electric have satisfactory business profiles of '5' (business profiles are ranked from '1' (excellent) to '10' (vulnerable) and somewhat weak financial measures. HEI's business position is characterized by limited competitive threats due to the utility's geographic isolation, nominal stranded-asset risk, a good fuel adjustment clause, and solid banking operations. These strengths are tempered by Hawaii's economic dependence on a limited number of industries, reliance on fuel oil, strained capacity reserve margins, and significant purchased power obligations. With regard to the bank, its earnings have been challenged by margin compression and rising interest

A responsive final rate order from the Hawaii Public Utilities Commission (PUC) with regard to Hawaiian Electric's 2005 rate case is crucial to help lift key financial measures to more appropriate levels for the ratings. In September 2005, the PUC issued an interim net rate hike of \$41.1 million (3.3%) that is marginally supportive of current ratings. If the amount collected under the interim increase exceeds the amount of the increase ultimately approved in the PUC's final decision and order, the company must refund the excess to its ratepayers with interest. There are no time restrictions in which the PUC must issue a final order.

In December 2006, Hawaiian Electric filed for a 99.6 million (7.1%) rate increase. Also pending before the PUC is MECO's request for a 919 million

HECO T-19 ATTACHMENT 3 PAGE 2 OF 4 AUGUST 2007 SUPPLEMENT

[23-May-2007] Research Update: Hawaiian Electric Ratings Cut To 'BBB'; Outlook Stable Page 2 of 4

(5.3%) rate increase and HELCO's application for a \$29.9 million (9.24%) rate hike. The PUC must issue an interim decision within 11 months, indicating possible interim orders in mid 2007 to early 2008. Rate relief is targeted toward enhancing earnings and recovering increased costs and reliability investments.

Of some concern is Hawaii's Act 162, a new law which appears to confirm, in light of the state legislature's interest in promoting renewable energy, the PUC's ability to authorize the utility's fuel adjustment clause. Although no parties to the rate case seem to oppose the continuation of the clause, a material change to the fuel adjustment mechanism would harm the company's financial condition and detract from its currently satisfactory business profile.

A final order that closely mirrors the interim ruling on Hawaiian Electric's 2005 rate case, as well as a supportive order in its most recently filed rate application, will be critical to lift key financial metrics to levels that are suitable for Standard & Poor's guideposts for the 'BBB' rating category. Responsive rate decisions on RELCO's and MECO's pending rate cases will also help to support credit quality. With regard to HELCO, a settlement was reached for about 85% of the amount sought, or a \$24.6 million (7.6%) rate hike. Importantly, the Consumer Advocate determined that the fuel adjustment clause complied with Act 162 and should be continued.

Hawaii's economic growth is expected to be tied primarily to the rate of expansion in the mainland U.S. and Japan economies and increased military spending. The state's economy grew by an estimated 2.7% in 2006 and is expected to grow by 2.6% in 2007. Military and federal government spending remains strong as the U.S. Department of Defense has redeployed military assets to Hawaii. Tourism is also a significant component of the Hawaii economy, with visitor expenditures up 2.9% and visitor days slightly down 0.3%, respectively, in 2006 compared with record levels in 2005. Continued growth is expected in 2007, with projected increases of 1.5% in visitor days and 4.8% in visitor expenditures. Although the housing market appears to be stabilizing, the construction industry continues to be healthy as indicated by an 8% increase in 2006 building permits compared to 2005. However, future growth in residential construction may slow with rising interest rates.

The company's projected \$1.2 billion capital expenditure program over the next five years will focus predominantly on additions and improvements to transmission and distribution facilities (approximately 51%) and on generation projects (approximately 41%). The balance is for general plant and other projects. These estimates don't include outlays, which could be substantial, that would be required to comply with cooling water intake structure regulations or Regional Haze Rule amendments. Standard & Poor's expects that consolidated cash flow from operations will fall short of covering projected capital expenditures and dividends in nearby years, resulting in increased reliance on outside capital.

REI has certain bondholder protection metrics that are subpar for the current ratings. In this regard, total debt to capital (adjusted for purchased-power contracts, pensions and applying intermediate equity treatment to HECO's hybrids preferred securities) and funds from operations (FFO) to total debt are somewhat weak at roughly 61% and 16%, respectively. Adjusted FFO interest coverage remains healthy at about 3.5x. Accordingly, rate relief, tight cost controls, improved earnings, and credit supportive actions by management will be required to lift the company's overall financial profile to more suitable levels.

Short-term credit factors

The short-term corporate credit and commercial paper ratings on HEI and Hawaiian Electric are 'A-2'. Ongoing growth in the Hawaii economy should allow the electric utility to generate relatively stable cash flows. However, accelerating capital expenditures will necessitate a somewhat higher reliance rate relief and on external capital in nearby years.

HEI maintains a \$100 million unsecured revolving syndicated credit facility that expires on March 31, 2011. The covenants require HEI to maintain a nonconsolidated capitalization ratio of 50% or less and consolidated net

worth of \$850 million, with which the company is in compliance.

Hawaiian Electric maintains a \$175 million unsecured revolving syndicated

HECO T-19 **ATTACHMENT 3** PAGE 3 OF 4 **AUGUST 2007 SUPPLEMENT**

[23-May-2007] Research Update: Hawaiian Electric Ratings Cut To 'BBB'; Outlook Stable Page 3 of 4

credit facility that expires on March 31, 2011. Pursuant to the agreement, the company must maintain a consolidated common stock equity to capitalization ratio of at least 35%, with which the company is in compliance.

Both HEI's and Hawaiian Electric's facilities support the issuance of commercial paper, but may also be drawn for general corporate purposes. Hawaiian Electric's facility may also be drawn for capital expenditures. The facilities do not contain interest coverage ratio requirements, material adverse change clauses, or rating triggers. As of May 1, 2007, both HEI's and Hawaiian Electric's credit facilities were undrawn.

HEI has just \$10 million coming due in October 2007 and Hawaiian Electric has no maturing long-term debt until 2012. As of March 31, 2007, HEI had \$14.1 million of cash and cash equivalents (excluding American Savings Bank's cash and cash equivalents).

HEI has \$50 million of debt capacity remaining under a Rule 415 shelf registration and \$96 million remains on an omnibus shelf registration.

Outlook

The stable outlook on Hawaii Electric reflects expectations for supportive regulatory decisions in several pending rate cases and continued health in the Hawaii economy. Unsupportive rate treatment that would result in the erosion of key financial parameters, especially cash flow coverage of debt, and a slump in the Hawaiian economy could lead to downward rating pressure. Higher ratings are not foreseen over the outlook horizon, given HEI's relatively liberal debt burden and weak FFO to total debt ratio.

Ratings List

Downgraded

From

Hawaiian Electric Co. Inc.

Corporate Credit Rating BBB/Stable/A-2 Senior Unsecured BBB

BBB+/Negative/A-2

Preferred Stock

BBB-

Hawaii Electric Light Co. Inc.

Maui Electric Co. Ltd.

Corporate Credit Rating BBB/Stable/--Senior Unsecured BBB

BBB+/Negative/--BBB+

Ratings Affirmed

Hawaiian Electric Co. Inc.

Commercial Paper

To

Hawaiian Electric Industries Inc.

Corporate Credit Rating BBB/Stable/A-2

BBB/Negative/A-2

Senior Unsecured

Preferred Stock

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[23-May-2007] Research Update: Hawaiian Electric Ratings Cut To 'BBB'; Outlook Stable Page 4 of 4

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Global Credit Research Credit Opinion 21 DEC 2006

Credit Opinion: Hawailan Electric Company, In	Credit O	pinion:	Hawailan	Electric	Company.	Inc
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Hawailan Electric Company, Inc.

Honolulu, Hawaii, United States

Category	Moody's Rating
Outlook	Stable
Issuer Rating	Baa1
Preferred Stock	Baa3
Bkd Commercial Paper	P-2
Parent: Hawailan Electric Industries, Inc.	
Outlook	Stable
Senior Unsecured	Baa2
Bkd Commercial Paper	P-2
HECO Capital Trust III	
Outlook	Stable
Bkd Preferred Stock	Baa2

Contacts of the state of the st

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KeyIndicators and the second of the second o

Hawalian	Electric	Company, Inc.	

	Q3D6LTM	2005	2004	2003	2002
(CFO Pre-W/C + Interest) / Interest	4.4	4.7	4.6	4.5	4.4
(CFO Pre-W/C) / Debt	19.5%	19.5%	20.2%	22.0%	21.2%
(CFO Pre-W/C - Dvidends) / Debt	15.0%	14.5%	18.9%	14.5%	15.5%
(CFO Pre-W/C - Dvidends) / Capex	73.2%	68.7%	87.2%	88.1%	124.7%
Debt / Book Capitalization	49.2%	49.6%	47.1%	47.6%	49.6%
EBITDA Margin	8.2%	8.8%	10.8%	12.9%	15.4%

Note: For definitions of Moody's most common ratio terms please see the accompanying User's Guide.

Opinion

Company Profile

Hawallan Electric Company, Inc. (HECO) and its operating subsidiaries, Maul Electric Company, Limited (MECO) and Hawali Electric Light Company, Inc. (HELCO) are regulated electric public utilities that provide electricity to 95% of the state's 1.2 million residents on the islands of Oahu, Maui, Hawali, Lanai and Molokai. HECO serves the island of Oahu; MECO serves the island of Maui, Molokai, and Lanai; and HELCO serves the island of Hawali. HECO is a wholly-owned subsidiary of Hawalian Electric Industries, Inc.

Rating Rationale

HECO's Baa1 Issuer Rating reflects the relative earnings and cash flow stability of this vertically integrated utility, the relatively strong service territory growth that continues at HECO and its subsidiaries, the company's conservative financial management, including its back-to-basics business strategy, and the historically strong financial metrics that have resulted for this medium size utility. The rating also considers the increasing size of the company's capital programs, the need for timely regulatory support to help finance capital investment and to

maintain credit quality, and the associated challenges to implement rate increases in a state where retail electric rates are high.

Kev Credit Factors

1. Historically, HECO has produced relatively stable credit metrics.

HECO has historically been a stable producer of earnings and cash flow due to its position as a vertically integrated utility that serves 95% of the state, a growing service territory, and the receipt of incremental rate relief, including the September 2005 interim rate decision from the Hawaii Public Utilities Commission (Hawaii PuC). For the past three years, HECO's ratio of cash flow to adjusted debt has averaged around 20% and the ratio of cash flow to adjusted interest has averaged around 4.5 times over the same period. These financial measures, which incorporate Moody's standard adjustments, are consistent with a high Baa rated vertically-integrated utility and are in accordance with the guidelines in Moody's rating methodology for electric utilities in the mid-range of the medium global risk category.

2. Relatively strong service territory growth that continues to diversify

During 2005, the state's economy grew by 4.0% and it is expected to grow at around 3.3% for 2006. Economic growth continues to be fueled by strength in the tourism sector and from growth by the federal government. 2005 was a record year for tourism in Hawaii, with visitor days exceeding the 2004 record by 7.7%. For the first eight months of 2006, visitor days were relatively flat compared to the same period for 2005, but expenditures were up 4.5%. In recent years, the growth of federal government spending, principally military spending, has caused the Hawaiian economy to become less dependent upon tourism as a principal source of economic expansion. For example, total federal government expenditures in Hawaii, including military expenditures, were \$12.2 billion in fiscal year 2004, an increase of 8% over fiscal year 2003. Military spending, which is 39% of federal expenditures in Hawaii, increased 6% in fiscal year 2004 compared to fiscal year 2003.

3. Regulatory Support Remains Critical to Maintenance of Credit Quality

As noted in Moody's Rating Methodology for Global Regulated Electric Utilities, the supportiveness of the regulatory framework under which a utility operates is a critical rating factor. While regulatory decisions rendered by the Hawall PUC have generally resulted in supportive outcomes, Moody's notes an increasing degree of regulatory lag that exists in reaching final decisions in Hawaii. For example, HECO is still operating under an Interim order reached in September 2005 and along with subsidiaries, MECO and HELCO, have either filed or Intend to file additional rate requests in the near future due to the need to recover higher operating expenses. Additionally, supply and reliability related issues have surfaced throughout the state due to the growth in the economy and the age and inefficiency of some of the existing resources in the state. Given the increasing need for additional generation and reliability related resources, timely and supportive regulatory decisions remain key to the maintenance of HECO's credit quality.

4. Capital Programs for Utility Infrastructure Has Increased.

Capital expenditures for 2004 and 2005 exceeded \$200 million annually and capital expenditures for 2006 are expected to be in a similar range. Most of the capital investment has been associated with transmission and distribution investments as welf as new generation resources, all intended to meet growing demand and to improve reliability and supply options that exist on an aging electric system. HECO has also invested heavily in demand side management programs that are intended to reduce consumption and head off the need for additional peak time resources. Reflective of this capital investment requirement has been HECO's increase in operation and maintenance expense associated with their need to operate older, less efficient generation more frequently in order to satisfy higher demand requirements. HECO and its subsidiaries' ability to obtain timely and supportive regulatory treatment for its capital investment program remains an important rating consideration.

Rating Outlook

HECO's stable rating outlook reflects an expectation that the company will continue to manage its growth in a conservative fashion, that timely regulatory support for the company's sizeable capital program will occur, and that management will remain focused around its current back-to-basics business strategy.

What Could Change the Rating - Up

In light of the sizeable capital investment programs and the uncertainty that surrounds associated rate case decisions and rate requests contemplated by HECO and its subsidiaries, limited near-term prospects exist for the rating to be upgraded.

What Could Change the Rating - Down

The rating could be downgraded should weaker than expected regulatory support emerge, including the

continuation of regulatory lag, which ultimately causes earnings and sustainable cash flow to suffer.

Rating Factors and Management of the Control of the

Hawalian Electric Company, Inc.

Select Key Ratios for Global Regulated Electric

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Rating A Park The Company of the Com	& Aar	Aa	超AII.	A.	Baa	Baa	Важ	Bas
Level of Business Risk (1997)	Medium	Low	Medium	Low	Medium	Low	Medlum	Low
CFO pre-W/C to Interest (x) [1]	>6	>5	3.5-6.0	3.0- 5.7	2.7-5.0	2-4.0	<2.5	<2
CFO pre-W/C to Debt (%) [1]	>30	>22	22-30	12-22	13-25	5-13	<13	<5
CFO pre-W/C - Dividends to Debt (%) [1]	>25	>20	13-25	9-20	8-20	3-10	<10	<3
Total Debt to Book Capitalization (%)	<40	<50	40-60	50-70	50-70	60-75	>60	>70

[1] CFO pre-W/C, which is also referred to as FFO in the Global Regulated Electric Utilities Rating Methodology, is equal to net cash flow from operations less net changes in working capital items

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